New Medications.

PART I.

By Prof. Dujardin-Beaumetz.

NEW MEDICATIONS.

BY PROFESSOR DUJARDIN-BEAUMETZ,

Member of the Academy of Medicine and of the Council of Hygiene and Salubrity of the Seine; Physician to the Cochin Hospital; Editor-in-Chief of the Bulletin Général de Thérapeutique, Paris, France.

TRANSLATED BY

E. P. HURD, M. D.,

Member of the Massachusetts Medical Society; Member of the Climatological Society; Member of the Societé de Médicine Practique, (Paris, France). One of the Physicians to the Anna Jacques Hospital, Newburyport, Mass.

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TABLE OF CONTENTS.

CHAPTER.		PAGE.
I.	The Great Discoveries in Therapeutics of the past Fifty Years	1
II.	On New Cardiac Medicaments	18
III.	New Methods of Treating Stomach Diseases	43
	Appendix to Chapter III	61
IV.	New Gastro-Intestinal Medications	74
V.	Antiseptic Intestinal Medication	90
VI.	Antiseptic Medication in General	104
VII.	New Pulmonary Medications	120

TRANSLATOR'S PREFACE.

Dujardin-Beaumetz is now so well known in this country that any production of his will be welcomed by progressive American physicians.

Editor of a leading therapeutic journal (the *Bulletin Général de Thérapeutique*), physician-in-chief to the great Hospital Cochin, where multitudes of patients are constantly under his general supervision, and where a spacious amphitheatre has been erected for his use in clinical teaching, also a fine laboratory for clinical and physiological investigation, the author of this work by his pen and by his oral instruction is the centre of a wide influence, inspiring a host of ardent workers to alacrity, diligence and thoroughness in promoting the cause of scientific and practical medicine.

Of his numerous publications, the following have been translated by myself:

1. Clinical Therapeutics. G. S. Davis, Detroit. 1885. This book is the third volume of the *Lecons de Clinique Thérapeutique*.

2. Diseases of the Stomach and Intestines. Wm. Wood & Co., New York. 1886. (This volume belongs to the Medical Library Series for 1886.)

3. Diseases of the Heart. Two volumes. G. S. Davis, Detroit. 1887.

4. Diseases of the Liver. G. S. Davis, Detroit. 1888.

5. Diseases of the Kidney. G. S. Davis, Detroit. 1888.

Besides the above, which have appeared in book form, those who have files of the *Therapeutic Gazette* will find running through the numbers of the past four years, lectures whose *ensemble* constitutes the volumes which have been recently pub-

lished in France under the titles: "Le Hygiène Alimentairé," "L' Hygiène Prophylactique," "L' Hygiène Thérapeutique."

The term, New Medications, which has been chosen as the title of this book,is suggestive of the necessary implication that there are old medications, some very old, and which have been in vogue ever since the human race first emerged from a state of utter barbarism and learned to treat the sick by rational methods, rather than to leave them to the mischievous meddling of the wizard, the sorcerer, or the savage medicine man.

It cannot be asserted that the fathers of medicine were fools, or that the old medications which were the result of sound experience and observation, and have in past years been the basis of rational practice, are to be superseded by any new methods, except so far as the new better fulfil the indications, are more completely adapted to respond to enlightened views as to pathogeny, or furnish a more complete equipment to the physician. That some of the modern methods do meet these conditions and thus assert their right to pre-eminence, no careful reader can deny. The pathology of past ages furnished to the practitioner of medicine the same momentous problems for solution, and the same urgent indications; on the one hand, owing to the tardy progress of science, the data were lacking for a complete knowledge of the morbid conditions, and chemistry and pharmacology on the other hand, had not yet given to the profession their powerful auxiliary resources. Hence there was room for the therapeutic advances which the nineteenth century has realized.

To illustrate my meaning: Bromide of potassium is a comparatively new medicine, and no one will dispute that a great advance has been made in the treatment of the convulsive neuroses, and especially epilepsy, since this remedy was introduced into therapeutics, fulfilling, as it does. certain indications better than any of the old remedies. But this is

not all; this therapeutic gain is concomitant with a much more precise knowledge of these convulsive disorders than our predecessors possessed, as will be seen by comparing with our present treatises any standard medical work published a hundred years ago.

But it is unquestionably true that some of the "old medications" were bad, and the enlightened physician of to-day has discarded them for modes of treatment more rational and scientific. Among these *bad* medications we may class bloodletting (which has almost passed into oblivion), and the antiphlogistic use of calomel.

Many of the medicaments on which physicians most rely are "old as the hills," and will probably hold their place in the Materia Medica as long as sickness continues on this planet. As a pure analgesic it is probable that opium will never be surpassed or superseded. Iodide of potassium and mercury will probably remain the best specifics with which to combat the accidents of syphilis. Quinine (which is simply a handy form of an old remedy, cinchona bark) will still be the antimalarial specific *par excellence*. Rhubarb, ipecac, senna, squills, and even castor oil, will still continue to meet certain indications, and will not be crowded out of the Pharmacopœia. But there will be a gradual weeding of the Materia Medica; many really useless medicines will be dropped, and less medicine will be given in the future; alimentation, hydrotherapy, etc., are to have a predominance—in fact the hygienic treatment of disease is destined to come to the front.

Of the "new medications," some are of prime utility. Sparteine and convallaria may be abandoned, but cocaine and acetanilid are permanent acquisitions to therapeutics. We may doubt the remedial value of grindelia robusta, but medical antisepsis has come to stay. Stomach washing (lavage) so exactly meets, therapeutically, certain pathological conditions that it must continue to hold a place in the treatment of stom-

achal diseases. Certain of the new antipyretics mentioned in these pages will doubtless prove to be of great utility in the future.

But progress in medicine is destined to be largely in the direction of what our author calls *etiological therapeutics*, *i. e.*, in more definite and thorough knowledge of the causes of disease, and the means requisite for their avoidance and elimination. The "coming man" will assiduously labor to avert the predisposing and exciting causes, and here the earnest co-operation of the hygienist and microbiologist will often render unnecessary the interference of the pharmacist.

In this work I have followed the author's second revised edition. The chapter on Lavage and Gavage of the Stomach is reprinted from the volume on Diseases of the Stomach and Intestines, which appeared in 1886.

It remains to add that this book comprises the Cochin Hospital lectures for the years 1884-85.

TRANSLATOR.

NEWBURYPORT, MASS.

PREFACE TO THE SECOND EDITION.

Four years have elapsed since the first edition appeared. The work has been carefully revised and numerous additions made, so that the principal recent acquisitions of therapeutics might be included. The appendices to the chapters in the first edition, with the exception of the appendix to Chapter III, have been omitted from this edition, and what has been added to the text has been taken from recent publications of the author.

E. P. HURD, M. D.

NEWBURYPORT, MASS., October 1st, 1890.

NEW MEDICATIONS.

CHAPTER I.

THE GREAT DISCOVERIES IN THERAPEUTICS OF THE PAST FIFTY YEARS.

GENTLEMEN: I intend to continue in this hospital the instruction in therapeutics to which my medical life is devoted. Begun in the Hospital St. Antoine, this clinical teaching has already given to the world the volumes on "Clinical Therapeutics," and I desire to add to and otherwise complete a work which has not I hope, been altogether without useful results.

The commencement of my course of therapeutic instruction at St. Antoine was attended with trying diffiulties by reason of the material conditions in which I was placed. To-day my task is rendered easy and pleasant by the generosity and liberality of the Directors in placing at my disposal all the conveniences necessary to facilitate and illustrate my course. Therefore I take this occasion publicly to thank the general manager and his secretary, M. Brelet, as well as the architect of this hospital, M.

Gallois, for the rapidity and dexterity which they have displayed in the execution of the different works which have transformed these ancient military barracks into a model modern hospital. For, by a happy concurrence of circumstances, we find here, united under one roof, the amphitheatre, the laboratory, and the patients, so that we are enabled to carry on the work of teaching along with our experimental researches and clinical studies.

In the present course we shall not leave the domain of practice, and it is always the application to the sick person which is ultimately to decide whether the medicament supposed to be indicated is of any value. The laboratory will be of use to us almost exclusively in enabling us to ascertain the physiological, and especially the toxic, effects of the medicine under consideration, for I have little faith in experimental therapeutics. Being unable to produce in animals the greater part of the diseases which affect the human species, it is impossible for us to study in them the therapeutic action of the principal medicinal substances. Ordinarily we observe in subjects under experimentation not the therapeutic action but the toxic effects of the medicament, and it is not experimental therapeutics which we realize, but experimental toxicology.

Are we then to abandon such researches? By no means, gentlemen, for a real interest attends them; they show us the more or less toxic influence of the

substance which we are testing, they guide us respecting the doses to employ, they often enable us, lastly, to give a physiological explanation of the effects observed. Hence you will see every day what great advantages you can derive from experimental researches of this kind.

These tasks of the laboratory will also include the means most fitted for isolating the active principles of medicinal substances. Finally, it is by the help of these laboratory experiments that we can examine attentively the modes of elimination of medicines, and thus complete the study of what has been described under the name of *pharmacodynamic action of medicinal preparations.*

Therefore, I would say to all those who prize the study of the treatment of diseases, to all those who are attracted by these researches of experimental physiology and therapeutics, to all who wish to glean in this immense field of materia medica, to all who desire to increase the number of our really useful therapeutic agents: Come to us; the doors of our wards are open to you; the laboratory, with all the means of investigation of modern science, is at your disposal; and you will find in me, in Dr. Bardet, chief of the laboratory, in my internes, Legendre and Sapelier, a readiness to give you the advice and the help which you require.

But in order to be good therapeutists, you must be good clinicians. Hence our teaching will not be exclusive, and to the lessons in Clinical Therapeutics

which I shall have the honor to give you, will be joined lectures in Semeiology which Drs. Legendre and Sapelier will deliver every Friday, and the Lectures in Medical Physics and Chemistry by my laboratory chief, Dr. Bardet; and I trust that you will derive profit from this multiple and complex course of instruction.

I shall devote this first lecture to the great therapeutic discoveries of the past fifty years. You must be tired of hearing it said that medicine has made no progress, that the treatment of diseases is just where the fathers of medicine left it. Others are free to admit that certain departments of the healing art have made advances, and point with complacency to recent valuable gains in surgery, obstetrics, and pathological anatomy, but as for therapeutics, it has not kept up with the progress made in other divisions of scientific medicine. You will hear these statements made not only by persons outside of the medical profession, but even by physicians in good standing; made, too, with such magisterial authority as to bring upon therapeutics undeserved opprobrium and contempt, and that branch of our science which ought to be the supreme end of medicine becomes a subject of little interest and is assigned to a secondary place.

Against this scorn and contempt I utter my protest to-day in showing you that therapeutics has made progress, and it is enough for me in this connection to sum up the great gains which it has achieved in the

last fifty years, to convince you that therapeutics has not been as far in arrear as has been supposed.

"To relieve pain is a divine work," says Hippocrates, and you will not be surprised to learn that it has been in the warfare with physical suffering that therapeutics has put forth its greatest efforts—efforts which have been attended with signal success, for the physician is now enabled to triumph over pain in its complete suppression. In this connection, then, I ought to speak of three grand modern discoveries; anæsthesia, the application of chloral, and the use of hypodermic injections.

ANÆSTHESIA.

The first in importance of all these discoveries is that of anæsthesia. I know of none more admirable or more useful, as by the sole fact of this discovery therapeutics has, in my judgment, surpassed all the other medical sciences. What would become of surgery if anæsthesia did not exist? How could we perform those remarkable operations on the abdomen without the chloroform sleep? Hence Figuier was right in placing induced anæsthesia among the wonders of science, and in the same rank with the modern uses of electricity, steam power, etc.

It was on the 1st of September, 1846, that there took place in Boston, between Dr. Jackson and Wm. Morton, a dentist, an interview which was destined to

decide the fate of anæsthesia. The latter had been seeking to obtain of Jackson some means which would enable him to extract without pain a tooth from a nervous patient. For four years Jackson had been experimenting with ether, and had noted its anæsthetic effect. He had been led to these investigations by the researches, early in this century, of Sir Humphrey Davy on protoxide of nitrogen, and believing the occasion favorable, he proposed to Morton to administer to his patient inhalations of ether. Morton was absolutely ignorant of what ether was, and Jackson provided him with a bottle of it.

That very evening, in his own house, Morton inhaled some of the ether, and noticed that for seven minutes he completely lost sensibility of the skin. The next day he boldly attempted that famous first experiment with a patient whose name science has preserved—Eben Frost, Esq. He caused him to inhale some ether, and during the anæsthesia which ensued, he extracted a tooth without pain.

One month afterwards, October 14, 1846, Dr. Warren, of Boston, at the Massachusetts General Hospital, performed ablation of a voluminous tumor of the neck on a patient anæsthetized by Morton; the patient experienced no pain. Surgical anæsthesia was discovered. But Morton, forgetful of his obligations to Jackson, did not invite him to be present at this test operation.

Two months after, December 22, 1849, Jobert de

Lamballe made the first application of etherization in France, at the Hospital St. Louis.

The year following, and only a few months after (in February, 1847), Sedillot proposed to substitute hydrochloric ether for sulphuric. A month later, viz., March 8th, Flourens, in a communication to the Academy of Sciences, studied comparatively the anæsthesia produced by sulphuric ether and that determined by hydrochloric ether, and proposed to employ a body which Soubeiran had discovered in 1830, and which resembled in many respects hydrochloric ether; this was chloroform. In the month of November of the same year, Simpson, of Edinburgh, applied the anæsthetic effects of chloroform to the human subject, and thereafter this new anæsthetic became the rival of ether in the production of surgical anæsthesia.

[Though chloroform is more speedy in its action, and produces more complete relaxation of the muscular system than ether, and though the after-effects are unquestionably somewhat pleasanter, yet ether is everywhere recognized as the *safer* anæsthetic, and on account of the many sudden deaths which have followed the administration of chloroform, the use of this anæsthetic in some parts of the world is (at least by popular and medical sentiment) condemned.] It is a curious fact, moreover, that while the whole world was celebrating the benefits of surgical anæsthesia, he who was the first to think of applying

Davy's discovery respecting laughing gas to surgical practice—I refer to Horace Wells—committed suicide, and by a strange freak of fate, he employed to accomplish his purpose etherization, which his triumphant opponents had just introduced into medical practice.

In this discovery empiricism had a place which was more apparent than real, and when we follow step by step the connection of events, we see that it was by a strictly logical process that the discovery of anæsthesia was brought about. Davy, guided by his researches on the action of gaseous substances on the economy, employs first nitrous oxide; Horace Wells aims to apply this gas to surgery, and fails in his first experiment; Jackson suggests vapor of ether and Morton carries out the suggestion and obtains anæsthesia thereby. Sedillot endeavors to substitute hydrochloric ether for sulphuric, and Flourens proposes chloroform which has so many affinities with hydrochloric ether. Finally Simpson establishes the bases of chloroformization.

Hence, then, gentlemen, it was by a comparative study of the substances belonging to the same chemical series that this grand discovery was made. But this comparative study did not stop with chloroform, and the other members of the group of ethyls and methyls were next taken up, and a great number of substances have been found, which, without displacing chloroform which still stands at the head of anæs-

thetics, none the less have rendered important services in the department of surgical anæsthesia. It was this same comparative study which led Liebreich to the knowledge of that powerful hypnotic, chloral hydrate.

CHLORAL.

Liebreich, in 1869, wishing to examine (as he himself says) the effects of certain substances which undergo decomposition in the organism, studied comparatively trichloracetic acid, its salts and chloral, aud showed the hypnotic properties of this latter body, which Liebig many years before (in 1831) had obtained by directing a current of dry chlorine upon absolute alcohol, and which Dumas studied anew in 1834.

You all know, gentlemen, the immense advantage which we daily derive from chloral, the annual consumption of which amounts to thousands of kilogrammes.

It was the same comparative study which led Cervello to counsel the usage of paraldehyd, for when you examine the atomic formula of chloral you see that it may be regarded as an aldehyd, the trichlorated aldehyd; hence the thought suggested itself of employing this paraldehyd, which is simply constituted by the union of three molecules ot aldehyd. One of my pupils, Dr. Coudray, has lately embodied in his thesis the results which he has observed in our hospital service from the employ of this new hypnotic.*

* Coudray, On Paraldehyde, Thèse de Paris, 1884.

But the discovery of surgical anæsthesia, and the introduction of chloral and its derivatives into medical therapeutics, were not yet sufficient to allay all pains, and in particular neuralgic pains. The finding of a method which has, so to speak, revolutionized medical practice in henceforth furnishing a positive and rapid means for the introduction and absorption of medicaments, ought to complete these first discoveries: I allude to the practice of hypodermic injections.

HYPODERMIC INJECTIONS.

It is to a Frenchman that we are indebted for the first idea, or at least the first practical tentatives of the hypodermic method. On the 27th of December, 1838, Dr. Lafargue, of St. Emilion, presented to the Academy of Medicine a memoir having for its title: "On the Therapeutic Effects of Certain Medicaments introduced Under the Skin." Nine years after, in 1847, Lafargue returned to this method, and noted with regret that despite the advantages which he had derived from it, *the practice of inoculation of medicaments*, as he called it, had been received with the most complete indifference, and that nobody had put it into use.*

In order to practice these medicinal inoculations, Lafargue proposed the following means:

* Lafargue, On the Therapeutic Advantages of the Inoculation of Morphine and Other Energetic Medicaments (Bull. Gen. de Ther., 1847, xxxvii).

A long needle is taken containing a deep grove running its whole length, which is filled with muriate of morphia reduced to a paste; thus armed, this needle is plunged into the tissues and allowed to remain there till the morphine is dissolved.

It is sufficient to read this passage of Lafargue to see how little was needed to transform the method of inoculation of medicaments into that of hypodermic injections, and this is what was done thirty years ago by a Scotch physician by the name of Wood.

Guided by the labors of Lafargue, guided also by the tentatives made by Ferguson and Pravaz in the radical cure of varices by coagulating injections, Wood proposed the use of the instruments now employed for the introduction under the skin of medicinal substances, and in 1859 my regretted master, Behier, made known all the advantages which accrue to the hypodermic method.

You know to-day the uses as well as the abuses of subcutaneous injections, and what advantages we derive from them There is no pain so stubborn as to resist this medication, and we can affirm that by its means we always give relief to our patients.

An Irish physician by the name of Rynd has disputed with Wood the priority of the discovery of the hypodermic injection, claiming that in 1841, that is to say, almost ten years before Wood published his memoir, he was in the habit of treating sciatica by hypodermic injections. But, when you read attentively Rynd's article, you perceive that he was not the

inventor of the subcutaneous method from the point of view of the introduction of calmative medicaments such as morphine, but rather from that of injections for local effect, which our colleague, Dr. Luton, of Rheims, was the first to practice in 1869, and to which in 1875 he devoted his able treatise on subcutaneous injections for local effect. In fact, Rynd employed to cure sciatica a mixture of morphine and of creosote.

I cannot here, gentlemen, point out all the advantages of the hypodermic method. Applied first to the introduction of calmative medicaments, this method was soon generalized, and you know to-day that it is the only sure means of introducing medicinal substances, and if we are now seeking with so much care to find the active principles of medicines, it is in order to put in practice this mode of introduction.

To all these new means of cure has been added the discovery of a substance which by its action on the bulbus and the entire cerebro-spinal axis was destined to render immense service in the treatment of nervous affections, and enable us to cure epilepsy in half the cases; I refer to BROMIDE OF POTASSIUM.

In 1826, Balard discovered bromine; two years afterward (in 1828), a Fellow of the Faculty of Montpellier, Pourchet, applied bromine, or rather its combination with potassa which he called hydro-bromuret of potash, to the treatment of scrofula and goitre, thus substituting, by an effort of reasoning easy to understand, bromine for iodine, its congener, the first

application of which to therapeutics was made several years before (in 1820) by Coindet, of Geneva, who was, thus, the creator of the iodide medication.

It is this same idea that inspired the attempts made long afterward, from 1840 to 1850, by Puche and Ricord, in the Hospital du Midi, to substitute bromide of potassium for the iodide in the treatment of syphilitic affections, which tentatives served as a basis for the theses of Rames of Aurillac, and of Huet, of Montargis, theses approved in 1850.

The year following, in 1851, Locock, taking a hint from a fact communicated in 1840 by a German physician, Otto Graff, relative to the anaphrodisiac properties of bromide of potassium, applied for the first time this medicament to the treatment of certain neuroses, in which he thought that the genital sense played an important part. The marvellous results which he obtained in epilepsy, results soon verified in France, laid the foundation of the bromide medication, which now occupies so large a place in the therapeutics of nervous affections, that we ask ourselves how we could get along without this precious medicament.

You see then, gentlemen, that the art of healing, or more strictly speaking, the art of relieving pain, has in a short space of time profited by five important discoveries. In 1846 occurred the discovery of etherization; in 1847, the application of chloroform to medicine; in 1851, the application of the bromide

medication to the treatment of neuroses; in 1853, the introduction of the hypodermic method into therapeutics; in 1869, the discovery of the hypnotic action of chloral.

While progress was being made in this direction, new horizons were opened to therapeusis by the discovery of a series of bodies which the industry of the chemist has succeeding in extracting from the residue of the fabrication of coal gas. I allude to the PHENOLS and OXYPHENOLS.

Here, too, it was not pure empiricism which led to these discoveries, but they were the result of two grand factors; on the one hand the new views which Pasteur had put forth respecting the nature of fermentations, and on the other the incessant progress of chemistry. The new ideas on fermentation show us its analogy with putrefaction, and especially the predominant rôle of micro-organisms in these phenomena, and finally the capital importance of antiseptic substances in preventing the development of these proto-organisms.

All these discoveries threw a new light on the pathogeny of accidents complicating wounds, and it is easy to understand the zeal with which surgeons pressed into this new therapeutic path, and with an enthusiasm the greater from the fact that chemistry had just discovered, as a result of the distillation of coal and the analytic decomposition of tar, a new series of bodies to which was given the name of *aromatic series.*

I took part in the first trials with these products, and the observations which, while in the service of Velpeau, whose interne I then was, in 1859, I collated concerning the power of coal tar, recommended by Cocne and Demeaux, helped to make the report which my illustrious master some time after presented to the Academy of Medicine. The action of the coal tar was not at all doubtful, but the question was often asked if these effects were not due to some principle in the tar rather than to the tar itself, and this led to the employment of phenic or carbolic acid, which Runge in 1834 had extracted from tar, and to which, as being a by-product of the fabrication of illuminating gas, he had given the name of *phenol* from the Greek *Φαίνω*, "I illumine." Lemaire in 1861 was the first to show the useful applications which might be made of phenol, and from this time we have seen medicine and surgery employ all the bodies which are derivable from these phenols and from their combinations, and successively salicylic acid, kairin, resorcin, etc., have been brought before the profession. But the internal application of these phenols and oxyphenols showed us that these antifermentative medicaments all possess a very important property, that of lowering the temperature, thus assimilating the febrile process to a process of fermentation, and thereupon a new group of antithermic medicaments was constituted.

This class of antithermic medicaments, to which

I shall shortly devote a whole chapter, has in our day assumed a capital importance.

Since the introduction of the thermometer into clinical practice, and since the custom was established of daily noting the cyclical march of diseases by the careful observation of the thermometer, a considerable importance has been attached to the temperature in diseases, an importance which has perhaps even been exaggerated, and there is a tendency always to endeavor to bring back to the normal the inordinate temperature of fever patients. You will see that we can attain this end by the employment of medicaments the discovery of which is quite recent, and with which we can lower at will the febrile hyperthermia.

Among these medicaments, there is one which, by its special action in rheumatism has a rank without a peer; I allude to salicylic acid. It is to Stricker, in 1876, that we are indebted for the first exhibition of salicylic acid in rheumatism; the application in this case was, I am aware, absolutely empirical. From time immemorial, the infusion of willow bark had been employed in the treatment of rheumatism; the discovery made by Leroux in 1827 of salicin had been applied only to the treatment of intermittent fevers, and when Stricker proposed to treat rheumatism with salicylic acid, it was a notion absolutely empirical which guided him. Moreover, we are still ignorant of how this medicament acts, while recognizing its marvelous efficacy, since in the immense majority of

cases, it causes disappearance of the atrocious pains and fever provoked by acute articular rheumatism.

Such, gentlemen are the precious acquisitions of therapeutics the last fifty years. To all such as may deny that therapeutics has made progress, it will be sufficient to point to the facts I have just indicated, and it will be made plain to any unprejudiced person that therapeutics, like the other branches of medicine, has not failed to make great gains.

Let us indulge the belief, however, that this is but the beginning. The discoveries of our illustrious countryman whom the entire scientific world has lately so signally honored at Edinburgh and at Copenhagen, are but a foretaste of future gains, and when I look at the rapid progress that is being made in researches of this kind, and when I think of the revolutions which the art of medicine is destined to undergo as a result of the more complete knowledge of the micro-organisms, and of inoculations of attenuated virus, I am ready, in my turn, to exclaim: "Happy are our young men, for great things are in store for them."

CHAPTER II.

ON NEW CARDIAC MEDICAMENTS.

GENTLEMEN: I shall devote this lecture to a consideration of the new cardiac medicaments, and by that word *new* I mean medicines which have been introduced into therapeutics the past five years.

Three new medicaments have been recently brought into repute in the treatment of heart diseases, and it is to these chiefly that I shall call your attention: convallaria, caffeine, and trinitrin; the two first being applicable to mitral affections and acting as tonics to the heart; the third, on the other hand, being chiefly of use in diseases of the aortic orifice and aorta. This distinction between mitral and aortic diseases, from the standpoint of therapeutics, is one which I endeavored to establish in my work on Diseases of the Heart, and seems to-day to be generally admitted.*

You know that from the point of view of treatment I have maintained that it was necessary to make a marked difference between mitral and aortic affections. In the first we must endeavor to augment the force of the heart to make it equal to its tasks, and we attempt this by means of the group of medicines known as *tonics of the heart.* In order better to mark

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* Diseases of the Heart, Part I. Published by Geo. S. Davis, Detroit, Mich.

the time when the cardiac tonics are of the most service, clinicians have divided into several periods the cycle which the heart affection traverses, from the simple lesion of the orifice to the cachexia, and Fernet and Huchard have characterized these periods by a peculiar name. In the first period, to which they give the name *ensystolic*, there is lesion of the orifice without alteration of the myocardium; hygienic means are alone of utility in this period. In the second period, which they call *hypersystolic*, cardiac hypertrophy comes in to compensate the troubles due to the lesion of orifice, and here, too, hygienic treatment suffices. In the third period, called *hyposystolic*, the equilibrium is broken, the compensation is insufficient, the tonics of the heart are necessary. In the last period, called *asystolic*, the heart is affected with fatty degeneration, there is, as Gubler says, cardioplegia, and the most energetic of our cardiac tonics, caffeine perhaps excepted, become impotent to combat this state.*

In diseases of the aortic orifice, therapeutics must be directed differently, and we are now concerned with combating the two symptoms which result from lesions of this orifice, namely, the cerebral anæmia and the irritation of the nerve plexuses which surround the aorta, and it is here that the medicaments which

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* Fernet, on Digitalis in Diseases of the Heart (Bull. et Mem. de la Soc. de Therapeutique, 1882). Huchard, on Caffeine in Affections of the Heart (Bull. de Ther., ciii, p. 145).

stimulate the cerebral circulation, and those which diminish nervous sensibility, find their application.

It must be understood that this distinction in treatment is only applicable to one phase of diseases of the heart, and that in the case of affections of the aortic orifice—insufficiency, for example—there ar-arrives a moment when, in consequence of dilatation of the heart, there is mitral insufficiency; then all the troubles which characterize this latter disease appear, and tonic treatment is imperatively needed, together with those remedies that favor the cerebral circulation and relieve distress.

As for the tonics of the heart, digitalis deserves the first place; next in importance (strange to say) comes bromide of potassium, as I have shown in my Diseases of the Heart; next in order we should now add convallaria and caffeine.

CONVALLARIA MAJALIS.

Convallaria majalis (muguet; lily of the valley) is a plant with rhizoma, which grows in abundance in our woods, and which presents at this very moment its racemes of odorous white flowers. The first analyses of this plant were made in 1858, by Wals, who found there two glucosides, convallamarin and convallarin. In 1865, Marmet studied the physiological action of these two glucosides, and, according to him, convallarin is purgative, and convallamarin toxic. In 1883 Ernest Hardy, then M. Tanret, each inde-

pendently, perfected the mode of extraction of these two substances.

In China, the inhabitants make use, as a succulent vegetable, of the young shoots of a species of convallaria, *Polygonatum Japonicum*, which has with them much the same place as asparagus has with us.

In Russia, the natives employ as a diuretic, another species of convallaria, the *Convallaria polygonatum*, so well known in our woods under the name of Solomon's Seal; such use of this plant, probably, first led the Russian physicians to make trial of the lily of the valley in heart affections. I say *first*, for it is probable that the Russian physicians did not know that in the middle of the 18th century (1745), Cartheuser, the celebrated physician of Frankfort on the Oder, in his rudiments of Materia Medica, mentions among the numerous properties which he ascribes to the lily of the valley, that of calming cardiac palpitations, and of toning up the weak heart, and that Ferrein, in 1770, mentions, also, the diuretic properties of convallaria. In his recent thesis on convallaria, Nogues has clearly proved the priority which is due to Cartheuser.* Ernest Labbèe has, however, shown still more recently that Matthiolus, in 1580, in his communications of Dioscorides, refers to the lily of the valley as being very beneficial in palpitations; "it fortifies the heart," he says.†

* Cartheuser, Matières Medicales. Ed. 1745, Perrien, Matières Medicales, 1771. Nogues, Thése de Paris, 1883.

† Ernest Labbée, Du Convallaria Maialis (Gaz. Hebd. June 13, 1884),

However this may be, all these facts had been forgotten when appeared the first researches, made under the inspiration of Botkin and his pupils, Bogojavolenski and Troitzi.

Bogojavolenski pointed out, in 1880, the results obtained by the employment of convallaria. Also Isaieff, Kalmikof, in 1881, Troitzi, in 1882, D'Ary, in 1881. And finally Germain Sée, in 1882, repeated these experiments, which he completed by new researches, and made known the advantages which we may derive from the employment of this medicament.

The researches of the Russian physicians, those of Germain Sée and of Bochefontaine, and those still more recent of Coze and Simons, have shown that in animals, and especially in cold-blooded animals, the divers preparations of convallaria, have a real tonic action on the heart. The sphygmographic tracings which these last two experimentors have furnished, show that not only convallaria diminishes the number of pulsations, but that it does this while augmenting the amplitude of the contractions. It is to this period of slowing and augmentation of amplitude that these experimentors have given the appropriate name of the *therapeutically useful period* of convallaria, and when you compare this useful period with that which belongs to digitalis in like doses, it is found that the superiority is to be assigned to convallaria.

From the standpoint of its action in man, this medicine is proven to be one of the most powerful

diuretics known, and Prof. Sée ranks it before digitalis. It is applicable, then, especially to mitral diseases with dropsy; at the same time, it is well to make this reserve, that when there is albuminuria, the diuretic action is considerably lessened.

Convallaria calms also the palpitations and disorders of the heart which are purely functional in character, and if I add that the preparations of this medicament have no toxic action in man, I shall have pointed out their principal advantages.

Since the labors of the Russian physicians, and especially since the communication of Prof. Sée, there have been a multitude of trials made with convallaria, and we know to-day, thanks to this experimentation, the true value of this medicament.

In Germany convallaria has had but little success, especially if we are to judge by the article published by Stiller, who, in twenty-one cases of affections of the heart where convallaria was employed, saw no positive results, except in two cases.*

In America convallaria seems to have had better results, as you will see by referring to the communications made by my excellent friend, Dr. Hurd, of Newburyport, and Drs. Beverly Robinson, Taylor, Polk, Smith,† and others, all of whom have had success with this medicament.

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*Stiller, Versuche über Convallaria Maialis bei Herzkrankheiten (Wien. Med. Woch., No. 44, 1882).

†Therapeutic Gazette, 1883, p. 283, also pp. 365, 126 etc. See also Medical Record, vol. 23, p. 413).

In France, if we can base our opinion on treatises published since the communication of Prof. Sée, and discussions before the Society of Therapeutics, it is plain that if the profession is agreed in admitting the diuretic effect of convallaria, the action of this medicament is nevertheless regarded as very uncertain. This is the view very clearly expressed by Peter in his Clinical Lessons on Diseases of the Heart; by Constantine Paul, in his late work;* and it is also my conclusion. In fact, in the numerous trials which I have made of convallaria, I have sometimes met with success—in a small number of cases it is true,—but very generally with failure. Despite this uncertain action, however, I believe that we do well to continue prescribing this tonic of the heart, because it is perfectly safe, and because it can be utilized at such times as we are obliged to leave off the administration of digitalis.

You know, in fact, that everybody is agreed at the present day in the expediency of not giving the preparations of digitalis continuously, and in interrupting for a certain time treatment by digitalis, to renew it again after a suitable interval. It is during this period of suspension of the foxglove that you can employ convallaria, taking care, of course, not to attribute all the diuretic effects thereafter obtained to this medicine, for, as you know, the action of digitalis on the

*On Diseases of the Heart. Published by Wm. Wood & Co., Medical Library series, 1884.

kidneys is prolonged for some time after you cease its administration.

How and in what dose shall you give convallaria? All parts of the plant, flowers, leaves and root, have been employed. The more active parts are the flowers; then the leaves; the plant may be used in the fresh state in the form of alcoholic extract, or in the dry state, as tincture or as extract. The infusion is an untrustworthy preparation. The extract is generally used; that may be either fluid or solid; that made from the flowers and the leaves is preferred. I here place before you the various extracts of flowers and leaves, which have been furnished me by M. Adrien, and you observe that they are of brilliant black appearance, of a quite peculiar bitter savor, and soluble in every proportion in water and in alcohol. A good diuretic mixture, of which a tablespoonful three or four times a day may be given, may be made by rubbing up a couple of drachms of the extract of the flowers and leaves, in eight fluidounces of decoction of broomtop. The American fluid extract made by Parke, Davis & Co., is quite a reliable preparation. I here show you a sample. You remark that it has perceptibly the odor and taste of the flowers. The dose of these liquid extracts is from ten to thirty drops, three times a day. The dose of the solid extracts is about ten grains, but the extract prepared from the root is very much weaker. Whatever form you may choose, do not count on obtaining certain results, and be prepared for disappointment.

CAFFEINE.

Quite different is the preparation of which I am now to speak. Caffeine is, in fact, one of the best tonics of the heart, and in the last stages of cardiac affections it will render you more service than digitalis. Extracted for the first time in 1820, by Runge, obtained under the name of theine, from tea, in 1827, and in 1840 by Martius, from *Paullinia sorbilis*, under the name of guaranine, also from Paraguayan *maté*, under the name of mateine, by Stenhouse in 1840. caffeine, which has an atomic formula of $C_8H_{10}N_4O_2$, may be got from these different substances, to which we may add that precious fruit on which we are experimenting this moment in our hospitals, and of which the negroes of Central Africa make so great account, kola (*Sterculia kola*), and which contains, as has been shown by the researches of Heckle and Schlagdenhaufen, caffeine and theobromine, and which has even more caffeine than coffee; the last, in fact, contains from 70 centigrammes to a gramme and a half in every hundred parts, while kola contains twice as much.

Caffeine presents itself under the form of a white crystalline salt, soluble in 90 parts of water. As Tanret has shown, its basic properties are very weak and there does not exist properly speaking, either acetate, citrate, valerianate, or lactate of caffeine. The bromhydrate and the chlorhydrate appear in the form of beautiful crystals, which are however, insoluble.

Tanret, therefore, has proposed a more stable combination of caffeine with salicylate or benzoate of soda. The first contains 45 per cent. caffeine, the second 61 per cent. These combinations being quite soluble, and having no local irritant action, may be used by the subcutaneous method. These are the formulæ which Tanret has proposed.

℞ Benzoate of soda, 2.95 (gr. xliv).
Caffeine, 2.50 (gr. xxxvj).
Distilled water, 6.00 (gr. xc).
M. Fiat solutio.

Each syringeful, or about 15 minims, contains a full dose of caffeine. (In other words, a cubic centimetre [about 20 drops] has 25 centigrammes.)

The second formula is as follows:

℞ Salicylate of soda, 3.10 (gr. xlvij).
Caffeine, 4.00 (ʒ j).
Distilled water, 6.00 (ʒ jss).
M. Dissolve with the help of heat. Each cubic centimetre contains 40 centigrammes caffein.

You need, however, resort to the hypodermic method only in exceptional cases, as when the patient is taken with vomiting, or when the caffeine provokes gastric irritation and pain. Ordinarily the caffeine may be given in pills, in granules, in capsules, or in potion.

The pill form is not much employed. This results from the fact that the pills may pass through the intestinal tube without undergoing solution and ab-

sorption, or the absorption may be incomplete, which is a disadvantage, seeing that caffeine is dear. The granules are good preparations, but are open to the same objection, and to get the full benefit of them large doses must be given—even two grammes (℥ ss) a day.

As for the capsules, this is an excellent mode of administration, and you may prescribe in this form doses of from 25 to 50 centigrammes (4 to 8 grains). They have, however, the inconvenience of causing distress in the stomach (one of the disadvantages of caffeine in concentrated form). Therefore, I prefer the liquid form, giving the medicine with a large quantity of the fluid menstruum.

You may, for instance, give three times a day a ten-grain dose of caffeine (pretty large doses are necessary, as I shall tell you hereafter); this may be given along with ten grains of benzoate of soda, a little syrup, and enough fennel or peppermint water to make up three or four ounces. The following formula may be more convenient for private practice:

℞ Caffeine, 7.00 (gr. 105).
Benzoate of soda, 7.00 (gr. 105).
Water, 250.00 (℥ viij).
M.

Each tablespoonful of the above mixture contains about 50 centigrammes (or 7½ grains) of caffeine.

Leaving one side all which does not concern the action of caffeine on the circulation, I shall take up

this aspect of the question, and shall now consider the physiological effects of caffeine on the heart.

When you take a glance at what has been written relative to the action of caffeine and of coffee on the heart, you observe that the opinions may be ranged in three groups; some, as Gentilhomme, of Rheims, claiming that caffeine has no action on the heart; others, as Trousseau, Rognetta, Dettel, etc., that it accelerates the pulsations of the heart; others still, notably, Caron, Meplain, and Foussagrives, that it slows the pulsations of that organ.

Whence comes this diversity of opinions? It results from this fact, which is applicable to so many of the tonics of the heart, that the toxic effects are absolutely opposed to the therapeutic effects, and while caffeine in moderate doses (as Giraud and Leblond have proved)* diminishes the pulsations while augmenting the vascular tension—*i. e.*, by acting as a cardiac tonic—in larger doses it produces toxic effects, the heart-beats are accelerated and become irregular; the caffeine has become a poison. You see then that the effects obtained by experimentation on animals have been in accordance with the dose administered.

It was in 1839 that an anonymous writer in the Bulletin General de Thèrapeutique, first pointed out the diuretic action of coffee and its applicability to

*Giraud. Contributions to the physiological and therapeutical study of Caffeine. Thèse de Paris. 1883. Leblond, Thése de Paris, 1883.

the treatment of dropsies; Zwinger, a Dutch physician, had, however, as early as 1725, recommended coffee for dropsy. Honoré, in 1846, published an article in which he reported three cases of albuminuria with anasarca, treated successfully by infusion of coffee.

In 1863 appeared the first treatise on caffeine, by Kœschlakoff of St. Petersburg, who reports two cases of parenchymatous nephritis with hypertrophy of the heart treated by caffeine; a remarkable diuretic action was noted, which was simultaneous with slowing of the heart's pulsations and increase of arterial pressure.

In 1866 Prof. Jaccoud took the lead in the employment of caffeine in cardiac affections, and we find in his *Clinique Medicale de la Charité*, this medicament recommended, not only for diseases of the heart, but also for the treatment of renal diseases with albuminuria. In 1877 Gubler, who considered caffeine as the ideal diuretic, made a communication to the Societé de Thérapeutique in which he strongly vaunted the remarkable effects of caffeine in cardiac affections. Still later, Brakerwidge, who has made more experiments with citrate of caffeine than almost any other man, called attention to the extraordinary merit of caffeine as a diuretic.

Thus far, however, but small doses of caffeine had been given, and this was in accordance with the practice of Gubler, who did not exceed the amount of

eight grains a day. Trials simultaneously made at Lyons by Prof. Lépine, and at Paris by Dr. Huchard, showed that these doses were insufficient, and that we ought not to hesitate to give as much as two grammes (or half a drachm) a day of this medicament in order to obtain all the benefit which may be derived from it; and you will find in the theses of Giraud and Leblond, the results obtained in the practice of Lepine and Huchard with these large doses of çaffeine.

The great advantage of caffeine is that it appears to possess diuretic effects even when the kidneys are badly damaged, and you may even get good results with it in advanced stages of heart disease. You will be able to see in our service veritable resurrections effected by this marvelous therapeutic agent, and this even in aged persons; therefore, you ought to have these facts always in mind, and remember that in the asystolic period—period of cardioplegia, as Gubler called it—when you have exhausted the remedial powers of all the other cardiac tonics, you may still obtain signal success with caffeine.

Kola nuts, with which you have seen me experiment recently in our wards (having obtained a supply direct from Dakar), may be utilized in these cases. Containing, as they do a considerable quantity of caffeine and theobromine, with a fatty matter, and being thus constituted an aliment and a tonic of the heart, our trials with this new medicament show that

this estimate is well founded. How will you prescribe kola? The three preparations the most in use are the alcoholic tincture, the wine and the elixir. The first may be given in the dose of one to two teaspoonsful; the wine is double this quantity, *t.i.d.* The elixir is made by diluting the alcoholic tincture with an equal quantity of syrup; dose, three or four dessertspoonsful a day. The infusion (which resembles infusion of coffee) is also a good preparation.

The tracings obtained in animals by Monnet show that kola is a powerful heart tonic. I have not, however, seen the marked diuretic results from kola that some authorities claim to have noticed; perhaps because I have not given it in sufficiently large doses. (See the thesis of my pupil Monnet, on Kola, published in 1884; of this an abstract was printed in the Therapeutic Gazette, 1885.)

I ought here to mention erythrophleine, which Gallois and Hardy have extracted from the *Erythrophleum Guinenseum*, and which has been physiologically studied by Professor Germain Sée and Dr. Bochefontaine recently. According to these experimenters, erythrophleine acts as a tonic of the heart. The toxic principle of erythrophleine is almost the same thing as amorphous digitalin. I have given the tincture of erythrophleum in 40-drop doses to patients suffering from mitral disease, but with variable results; sometimes I have obtained a powerful diuretic action, and sometimes no action

whatever. Further trials with this drug are necessary.

TRINITRIN (NITRO-GLYCERIN).

This new remedy is only of use in diseases of the aortic orifice. You well know the difference, from a therapeutic point of view, between mitral and aortic affections.

In aortic disorders, what we have to combat are the symptoms arising from the cerebral anæmia which comes from the trouble inflicted on the arterial circulation, and which manifests itself by pallor of the countenance, attacks of vertigo, lipothymia, and even syncope; we are called upon also to mitigate the distress which accompanies these affections, whether this be in the form of symptomatic neuritis of the cardio-pulmonary plexus, a result of the propagation of the peri-aortic inflammation to the numerous plexuses which surround that vessel, and thence to the peripheral nerves; or whether we are concerned with that veritable angina pectoris, of which Huchard has so well explained the mechanism in his recent work, showing us that these horribly painful paroxysms of thoracic angor result from ischæmia of the cardiac muscle.

You all know from a physiological as well as from a pathological standpoint, the excruciating suffering which accompanies sudden arrest of the circulation in a department of the economy furnished with sensory nerves, and you doubtless recall to your

mind the distress of patients affected with senile gangrene. When the coronary arteries become obliterated, the same painful phenomena are manifested and extend to the entire cardio-pulmonary plexus. The facts of Huchard, of Potain, and of my colleague, Herard, communicated to the Academy of Medicine, illustrate well the mechanism of angina pectoris.

Every medicament which energizes the cerebral circulation and that of the cardiac muscle on the one part, and calms pain on the other, is then useful in the treatment of aortic affections.

Opium, and especially morphia, give excellent results in these affections, and precisely by reason of the physiological properties of this medicine, which acts in these cases as a tonic and a calmative. I have also advised in like cases the nitrite of amyl. This nitrous-amyl ether, studied these late years physiologically, by Guthrie in 1859, in 1863 by R. Richardson, and of which you will find an account in the thesis of Marsat (1875) and of Veyrieres, presents this curious property of being a vaso-dilator poison, especially for the capillary system of the encephalon, and it is only necessary to breathe as you have seen done, a few drops of this medicament, to obtain a marked congestion of the face, which extends to the deeper parts, as you could convince yourself by direct examination of the brain in animals, or by ophthalmoscopic examination.

I have then employed the "congestioning" properties of this drug in the treatment of aortic affections, and in the first edition of my lectures on Clinical Therapeutics, nearly seven years ago, I called attention to the good results which may be obtained from nitrite of amyl; only this medication has not come into general use, and this for two reasons more especially: first, on account of the transitory effects of the medicine; next, on account of the tolerance of the economy, which, soon becoming habituated to these effects of vascular dilatation, fails to derive a therapeutic benefit. Therefore, I have recently substituted trinitrin for nitrite of amyl, the trinitrin having all the advantages of the other without the disadvantages.

Trinitrin was discovered in 1847, by Sobrero, and it was applied to the arts by a Swedish engineer called Nobel, in 1869, under the name of dynamite, and you are all acquainted with the uses which have been made of this substance by miners and engineers. It has also received the name of nitro-glycerin, for, in fact, trinitrin may be considered as a glycerin in which three atoms of hydrogen are replaced by three atoms of hyponitrous acid. In fine, homœopaths have utilized this substance under the name of glonoin.

From a pharmaceutical point of view, you should make use only of the one-per-cent. alcoholic solution, adding 30 drops to 100 grammes of water, of which

mixture a tablespoonful may be given, morning, noon, and night.

The prescription may be written as follows:

℞ Alcoholic sol. trinitrin (1 per cent.) gtt. xxx.
Water, grammes 100 (℥ x).

M. Sig.: A tablespoonful three times a day.

You can also employ the hypodermic method, using the following solution:

℞ Sol. trinitrin (1 per cent.) gtt. xxx.
Cherry laurel water, grammes x.

M. Sig.: For subcutaneous use.

Every fifteen minims contains three drops of the solution of trinitrin.*

When you study the physiological action of this medicine, you observe that as far as the toxic properties are concerned, experimentors have advanced opinions the most opposite, and while Bruel regards it as one of the most energetic poisons, we see Vulpian, on the contrary, maintain that its action is almost *nil* in animals; and in the experiments which I undertook anew with De Marieux, who has written an admirable thesis on the subject, we discovered why the objection exists. It is, in fact, because, while trinitrin seems to have a very energetic action on man, its physiological effects are scarcely appre-

* In American practice the tablet triturates, each containing one minim of the centestimal solution of nitro-glycerin, are chiefly employed.—Ed.]

ciable in animals, as the dog and the hare, so that while ten drops of a one-per-cent. solution determine in man toxic phenomena, you can introduce into the system of dogs as much as three drachms of the solution, and a proportionately large quantity in hares, without producing symptoms of poisoning. This shows you one of the difficulties of experimental therapeutics, and how careful you should be, in concluding from experiments on animals, as to what should take place in man.

When then you introduce under the skin of a man, three or four drops of trinitrin, you observe in a few seconds congestion of the face, the skin becomes warmer and is covered with sweat, the eyes are injected; the individual has headache, buzzings in the ears; it seems to him, as he says, as if his head would burst; the beating of the heart becomes more active. These effects are not merely localized at the periphery, they may also be observed by the ophthalmoscope in the optic disc; the deeper parts are flushed as well as the peripheral. These you see, are the same phenomena as those which are determined by nitrite of amyl, with this difference that the effects are more lasting.

It is to the homœopaths that we owe the first medicinal applications of trinitrin, and in 1848, almost as soon as it had been discovered, Hering of Philadelphia, recommended this medicament in homœopathic doses for certain cerebral affections; and faith-

ful to his principles, he prescribed it especially in cases of cerebral congestion and of apoplexy. Dudgeon, in 1853 advised it under the same conditions. In 1858 Field proposed trinitrin for certain neuroses, as epilepsy. Murray, in 1879, made the first trial of this medicament in angina pectoris, and finally, Mayo Robson, in 1880, advised it for albuminuria. In France it is only since the publication of Huchard's work, in 1880, that we seem to be definitely decided as to the therapeutic application of trinitrin, and this medical authority has shown us that its principal utility is in the treatment of angina pectoris; and here I must enter upon certain details.

It seems to-day demonstrated by the facts communicated by Potain, Huchard, and still more recently by Herard, that angina pectoris results from ischæmia of the myocardium, and there take place on the part of the heart, phenomena quite analogous to those which supervene in senile gangrene; and you easily understand why the pain of angina should be so intense when you think of the cruel suffering which attends senile gangrene.

Every medicament which energizes the capillary circulation of the heart or of the parts of the nervous system which innervate it, is then applicable to these cases, and this it is that explains the relief which vaso-dilator medicaments give. Trinitrin is not only applicable to the treatment of angina pectoris, but also to all the affections of the aorta, constriction

and insufficiency, in which we observe cerebral ischæmia, and in individuals suffering from such affections of the heart, where you observe vertigo, lipothymia, syncope, or other troubles dependent on this cerebral anæmia, you can still use with success the same medicine.

More than this, apart even from diseases of the heart, in intense chlorosis, in neuralgias from anæmic causes, in certain cases of hypochondriasis where the vaso-motor intestinal troubles by their intensity induce a veritable cerebral anæmia, you can still use to advantage trinitrin.

Three new medicaments have lately been added to the list of tonics of the heart, Adonidin, Sparteine, and *Strophanthus kombe.*

ADONIDIN.

Adonidin is the active principle of the *Adonis vernalis*, a ranunculus, from which it was first extracted by Vincenzo Cervello in 1882. Adonis was applied to the treatment of diseases of the heart in 1879 by Bubnow, assistant of Prof. Botkin, of St. Petersburg. These trials were repeated in France by Lesage and Mordagne, and by Huchard and Elroy. I myself experimented with adonidin in my hospital service in 1884. In 1885 Desplats and Durand published interesting papers on the cardio-tonic properties of adonis.

Adonidin, the glucoside of adonis, is the most

convenient preparation to use. The dose of one-third of a grain (20 milligrammes) should not be exceeded; if more than that is given, vomiting and intense gastric distress are produced. It is a good plan then to give every day one or two pills of a centigramme (⅙ grain) and you will obtain, especially if the administration be long continued, a real tonic effect on the heart; there will be increase of the arterial tension, the beatings of the heart become regular, the pulse diminishes in frequency, and diuresis is augmented. Adonidin then seems to have the same action as digitalis, without being attended with any danger of cumulative effects.

SPARTEINE.

Sparteine is the product of a species of broomtop, *Cytisus scoparius;* it is the alkaloid of the broomtop: the sulphate is the salt employed. The sulphate of sparteine is administered by centigrammes; 3 or 4 centigramme doses three times a day should be given, in pills or in syrup. Houdé's formula is as follows:

℞ Sulphate of Sparteine, gr. v. (cg. 30).
Syrup Aurantii Cort., ℥ x. (gms 300).

M. Sig. A tablespoonful contains two centigrammes (⅓ grain) of the active principle.

Laborde was the first to make known the tonic action of sparteine on the heart, and German Seé has shown us its therapeutic uses. Sparteine seems es-

pecially to be a regulator of the beatings of the heart. Seé commends it highly as a cardiac tonic.*

STROPHANTHUS.

Strophanthus kombe belongs to the series of arrow poisons, so much in use by the natives of Central Africa, studied in France from a physiological point of view by Pelikan and Vulpian, Pollillon and Carville, analyzed with care by Hardy Pallois who found these two active glucosides, *strophanthin* and *inein.* Strophanthus was introduced into therapeutics, byFraser, of Edinburgh, and Emile Pins, of Vienna, who made numerous trials with it in hospital and private practice. It was found to have an action much resembling that of digitalis in the uncompensated diseases of the heart. Fraser employed the mother tincture, the dose of which is from 2 to 4 drops. Pins made use of an alcoholic tincture less concentrated, the dose of which is 5 drops three times a day. Formerly the supply of this drug was scant; of late reliable tinctures are sufficiently abundant. It has been proposed to utilize strophanthin, the active principle, of which the dose is a quarter of a milligramme. I have made numerons trials with strophanthus in my hospital service, and my pupil Cazaux has embodied these trials in his inaugural thesis. I have made use of the tincture of the French pharmacopœia, which is a 1-5 alcoholic solution; the dose is 5 drops morning and evening. The results have often been favorable, but inferior to those of digitalis.

Such, gentlemen, are the principal modifications which have been introduced into the treatment of diseases of the heart, the last few years. They are, as you see, important and useful, and in my next lecture I shall undertake the consideration of a subject fully as important. I allude to the new methods of treating stomach diseases.

CHAPTER III.

NEW METHODS OF TREATING STOMACH DISEASES.

GENTLEMEN: There is no department of pathology which has been more favorably influenced by therapeutics than that which pertains to diseases of the stomach, and I desire on this occasion to bring before your notice three curative measures, which I deem of the greatest importance, and which seem to have revolutionized the treatment of gastric affections; these are of surgical nature and are comprehended under the heads: lavage, or washing out the stomach, gavage, or forced feeding, and the use of meat powders in the alimentation of the sick.

Encouraged by the success which the antiseptic method has given in operations practiced on the abdomen, surgeons have sought to effect active intervention in the disorders of the stomach, and have successively proposed *gastrotomy*, *gastrostomy*, and *gastrectomy*. I cannot give you here a complete account of these three operations, so I shall only point out their chief indications.

Gastrotomy consists, as you know, in opening the stomach, and this operation has been performed of late chiefly in order to remove from the cavity of that organ foreign bodies, and you are familiar with the interesting cases of Labbé and Felizet. It

has also been lately proposed to practice this operation in order to penetrate the stomach and gain access to the pylorus, for the purpose of dilating it with the fingers, and thus overcoming fibroid thickenings of this orifice or cicatricial bands causing stricture. This digital dilatation has never been performed in France, and the most serious objection which can be made against it is the difficulty of accurately diagnosticating beforehand the pathological condition requiring the operation.

The same objection may be made to gastrectomy as applied to the treatment of affections of the stomach, and to the difficulties of an operation which consists in removing a portion of the stomach and making a new pylorus, we must add the equal difficulty of correctly determining the nature of the malady, for in the great majority of cases we find it impossible to attain to certainty respecting the limits of the tumor which we would like to resect, and to know if there are not other tumors like it in other parts of the abdomen; therefore gastrectomy, practiced for the first time by Pean, and since then repeated so frequently in Germany, has seldom resulted in anything but failure, and to-day seems completely abandoned.

Gastrostomy, which is the establishment of a permanent opening in the walls of the stomach, is a much more rational operation, and has in numerous cases been attended with success. Gastrostomy may be performed under two different circumstances: when

there exists a stricture of the œsophagus and of the cardiac orifice, or when there is an obstruction at the pylorus. In strictures of the œsophagus, and when this tube becomes impermeable, gastrostomy is urgently demanded, and it is apparent that by means of this kind, one may succeed in supporting the life of the patient by a gastric fistula. The curious observation of Prof. Verneuil, respecting Marcelin, shows us the advantages which may be derived from this operation. If, moreover, in fibroid stricture it does not always give us equally good results, it is because the operation was too long put off, and the patient, worn out by prolonged abstinence, was unable to resist a severe surgical traumatism.

I believe gastrostomy perfectly indicated in cases of cancer of the cardia and of the œsophagus. There are, in fact, cancerous affections which become grave, not by the extent of their invasion, but because they constitute an insurmountable obstacle to the regular functions of organs indispensable to life. A cancer of very small dimensions situated at the pylorus or cardia occasions death by starvation, and it is easy to understand that one may be able to prolong the life of patients for months, or even years, by creating a new passage for the introduction of food.

When the obstacle is seated at the pylorus, surgical intervention of a different character is required, and gastrostomy in this case consists in establishing a new orifice for the stomach, which shall open not ex-

ternally, but into another part of the intestine. Surmay, of Ham, has advised to make the opening into the duodenum, and he has performed this operation in my service on a young woman 24 years of age, affected with cancer of the pylorus. The operation proposed by Billroth seems to me to constitute a notable advance on the preceding.

This operation consists in attaching a loop of intestine nearest the duodenum to the wall of the stomach, and in establishing there a communication between the two cavities, so that the stomach shall open into the intestine by a new pylorus. This operation does not involve the risk of loss of those fluids so necessary to intestinal digestion, the bile and pancreatic juice, which continue to flow into the upper part of the intestine. This is the operation which you ought to perform whenever there exists an obstacle at the pylorus effecting, or nearly effecting, closure, and for my part I have very much regretted that I did not resort to it in two cases where I had diagnosticated non-malignant stricture of the pylorus; the autopsy having shown my diagnosis to be true. I believe, moreover, that in certain forms of cancer of the pylorus, without any cachectic symptoms, this operation is indicated; for, leaving intact the tumor, it does not involve the grave risks of gastrectomy. Unfortunately, as in stricture of the œsophagus, we do not propose this surgical procedure except in the last stages of the disease, when the vital powers are low

and the patient is ill able to withstand the sequels of the operation.

Lavage of the stomach has accomplished as wonderful results in the treatment of gastric affections as surgical intervention, and although opposed to this new method formerly, as you may see by the first edition of my "Clinical Therapeutics," I have seen reason to change my mind; you can, in fact, see every day in my hospital service, instances of the good effects which we obtain from washing out the stomach in diseases of that viscus.

It must not be supposed that this lavage in its essential particulars is new; it was even proposed as far back as 1832 by a French physician, Blaton, who recommended washing out the stomach in chronic gastritis; but it is to Kussmaul, in 1867, that we are principally indebted for practical details as to the easy performance, the indications and contra-indications of the operation. The stomach syphon has contributed to render this practice current. It has been claimed that in 1829 Arnolt employed a soft rubber tube, and applied the theory of the syphon to the removal of the contents of the stomach. But it is to Oser, of Vienna, and Fauché, of Paris, that we owe the real discovery of syphonage, and it is since the communication of the latter to the Academy of Medicine in 1879, and his subsequent publications, that the method of Kussmaul has come into general use in France.

I need not describe here this stomach tube, with which you are all acquainted. I will only mention the useful improvement which Debove and Galante have made in the syphon, in giving to the part which penetrates the stomach more stiffness, while at the same time preserving its suppleness. I advise you always to commence your attempts at lavage with the tube of Debove, of which the introduction is very easy, since without the help of the patient you can make it pass down to the stomach, by successive impulsions. Then when the œsophagus and stomach are habituated to the presence of this foreign body, you can make use of the ordinary syphon, which demands for its introduction efforts of deglutition on the part of the patient. It will be well for you to make your patient take bromide of potassium for two or three days before the first attempt to wash out the stomach; you will thus obtain anæsthesia of the isthmus of the fauces, and diminish the reflexes which the introduction of the tube produces.

You should, moreover, not forget that in the passage of the tube the most painful sensation to the patient is that of respiratory embarassment, hence it would be well to recommend him to take as full breaths as possible. It is hardly necessary that I should describe minutely the manual manœuvres in the introduction of the tube; you are already familiar with them. You fill your funnel with the liquid designed for the lavage, then you elevate it, and when

the liquid begins to disappear, you immediately lower it. Often foreign particles stop up the orifice of the syphon. To get rid of them, you may make use of two means. Either you may make the patient cough, which causes the liquid to flow more freely, or you may start anew the suction action of the syphon by pouring in a certain quantity of water. I pass now to the different liquids which you may employ in the performance of lavage, and which constitute, so to speak, certain dressings for the mucous membrane.

For simple lavage you may make use of bicarbonate of soda water, or a solution of sulphate of soda. In the greater number of cases it is water artificially charged with one drachm of sodium bicarbonate to the quart that is used. The Germans seem to show a preference for the sulphate of soda, and you can employ a solution of this salt in the proportion of a drachm and a half to the quart of water in cases where very obstinate constipation complicates the stomach affection. You can also utilize the natural mineral waters, such as those of Vichy and Chatel-Guyon, for instance. When the contents of the stomach give indications of having undergone putrid fermentation, you can use with profit the various antiseptic solutions.

Andeer, who introduced resorcin into therapeutics, has proposed in these cases to wash out the stomach with one-per-cent. solutions of this disinfectant, and I have myself often resorted to this antiseptic

method, which has certain advantages, but is not without its disadvantages; I refer especially to the danger which is likely to result from absorption of this medicament when it is not all removed from the stomach by the syphon. Therefore, I much prefer boracic acid to resorcin, and I make my "lavages" with a one per-cent. solution of this acid and find that it disinfects the contents of the stomach perfectly well and may be absorbed without any bad effects. You can also use in cases of putrid dyspepsia Belloc's charcoal powder, and make your lavage with water containing from two to four tablespoonfuls of this wood charcoal.

When the matters returned by the syphon contain a certain quantity of digested blood, as happens in cases of ulcerous gastritis, you can perform the "lavage" with a solution of perchloride of iron of about the strength of a tablespoonful of the officinal liquor to a quart of water.

In fine, where there exist severe gastric pains, you can employ with advantage in solutions of bismuth, of chloroform water, or water containing a minute proportion of sulphide of carbon. The solution of bismuth which I have described under the name of "milk of bismuth" contains two tablespoonsful of sub-nitrate of bismuth in a pint of water; this solution is introduced by means of the flexible tube of Fauché. But instead of withdrawing the mixture immediately by the stomach tube, you wait three or

four minutes so that the subnitrate of bismuth may deposit itself on the mucous membrane of the stomach. Then you syphon out the remainder of the liquid.

Chloroform water is a new medicinal agent which we owe to Regnault and Lasègue. Nothing is more simple than the preparation of this chloroform water. You take a flask of the capacity of a quart; you fill it three-fourths full of water and add an indeterminate quantity of chloroform; you shake it several times, then you decant it with care so as to leave behind all the chloroform which is deposited. The solution which you thus obtain, and which keeps a strong odor of chloroform, is called "saturated chloroform water," and to make use of it for medicinal purposes you dilute it with an equal quantity of water. The patient should be made to take of this mixture a tablespoonful, morning, noon and evening. It is very easy to medicate this chloroform water with other substances introduced to serve certain indications; thus diffusible stimulants may be added, such as ammonia, peppermint, lavender, or a more decided sedative action may be obtained by the addition of some of the narcotics.

In cases of gastralgia, or simple pain in the stomach, this chloroform water so prepared may give excellent results when taken by the mouth instead of by the stomach tube. If you employ it in the form of lavage in cases of acute pain or intoler-

ance of the stomach, you can make your solution with two teaspoonsful of the saturated chloroform water to the quart of liquid.

Chloroform water is calmative and antiseptic, but these two properties are still more marked in the solution which I have denominated—

CARBON DISULPHIDE WATER.

This water has for its base, the disulphide of carbon. Kiandi Bey has shown the innocuousness of this substance, which Delpech considered as eminently toxic, and he has proved its high antiseptic power; and my excellent interne, Sapelier, who is devoting his inaugural thesis to the study of disulphide of carbon, has demonstrated by experiments on animals that the view of M. Kiandi is correct, and that you may give 20 30, or 40 centigrammes of this sulphuretted preparation to dogs without any danger.

The water of carbon disulphide is prepared like chloroform water, by agitating water containing a small quantity of the substance and decanting the liquid; the most of the sulphide of carbon is deposited on the bottom of the vessel, and is easily left behind during decantation. The water has a slight odor of fermented cabbage, which somewhat resembles that of chloroform. It contains a little more than one gramme of carbon disulphide to the quart of water. We give it diluted with an equal quantity of water, or with wine and water.

This mixture has no disagreeable taste or smell, and we give of it four, five, and even six tablespoonsful at a time. This water soothes pains in the stomach and arrests putrid fermentations, and we apply it not only to the treatment of dilatation of the stomach, but also internally in typhoid fever. (We shall return to this again in the next lecture on new intestinal medications.)

You can also make use of this carbon disulphide water in lavage of the stomach, and employ for this purpose a solution containing one-third of this liquid and two-thirds of pure water.

You know already the operative manœuvers in the performance of lavage; you know also the solutions which are in common use in washing out and in medicating the stomach; it remains for me now to indicate the temperature and the quantity of the liquids to employ, and the time for making these washings.

I am in the habit of using liquids at the temperature of the surrounding atmosphere; there is, however, a little risk in employing fluids at too low a temperature, and we had in our hospital wards one unfortunate case of pulmonary inflammation, resulting from the introduction of too great a quantity of cold water by the stomach tube; consequently I advise you to use water from which the chill has been taken, especially if you intend to introduce a large amount into the stomach. With regard to the quantity of liquid, there

is no invariable rule, and you ought, when you can, to prolong the lavage till the water which flows out is as clear as that which enters, or nearly so. Even here, however, there are differences depending on the greater or less tolerance of stomachs, and while some can support large quantities of water, others vomit when the water introduced exceeds a certain amount, which is sometimes very small.

You ought always to perform the lavage when the patient is fasting, and the time which seems to me the most favorable is the hour of rising in the morning; Leube, however, would have it performed the latter part of the afternoon.

Generally one lavage a day is sufficient, and it is only exceptionally that you need to have recourse to it twice a day. Moreover, the abuse of lavage is not without risk; the patients are fatigued, the peptonization of food is prevented, and sometimes the operation becomes the irritant cause of contractures, which in one case which I had last year under observation in the Hospital St. Antoine, took on a character of such gravity that the patient succumbed.* Thus far I have only spoken to you of the syphon, and before entering on the study of the indications and contra-indications for this method, I

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* Dujardin-Beaumetz and Œttinger, Note on a case of Dilatation of the Stomach, Complicated with Generalized Tetany, (Soc. Med. des Hôp, 26th Oct., 1883).

ought to say a word about other instruments in common use.

The stomach pump has been employed by Kussmaul, and I have myself made great use of it, and my pupil, Dr. Lafage, of Neuilly, has reported in his thesis a large number of cases where the stomach pump was employed. But since then I have more and more abandoned the pump, and believe that in the great majority of cases the syphon suffices. I here show you, however, the stomach sound with double current, invented by Audhoui, and I call your attention to the new apparatus of Boisseau du Rocher, which, based on the same principle as the double current tube, has for its object to establish a current in the interior of the stomach. I do not know whether these instruments are often employed, and for my part I have never had recourse to them.

In what cases ought you to practice lavage of the stomach? There is a formal indication for these washings whenever the stomach is dilated, whatever may be the cause of this dilation. You know that dilation of the stomach depends chiefly on three causes; either on a mechanical obstacle at the pylorus, as cancer or a cicatricial band, or an inflammation of the walls of the stomach which involves the muscular layer and paralyzes it (a morbid condition which almost always attends the prolonged gastritis of drunkards); or, lastly, it depends upon a peculiar state of the nervous system entailing paralysis, and

the mechanism of which is unknown to us,—this kind of dilatation is seen in neuropathies, such as hysteria.

You know also the important pathogenic rôle which Prof. Bouchard has assigned to this dilatation of the stomach, which he considers as the initial cause of a great number of secondary affections. In all these cases, lavage of the stomach will give you durable and permanent results when there are no incurable lesions, and a temporary benefit when you have to do with incurable lesions. In ridding the stomach of the liquids which embarrass it, in opposing the putrid fermentations which the prolonged sojourn of these liquids determines, and which have a considerable part (as I shall tell you in the next lecture) in the morbid symptoms which Prof. Bouchard has described under the name of stercoræmia, in stimulating the contraction of the muscular fibres, and finally in enabling you to medicate the mucous membrane of the stomach, lavage will give you astonishing results.

There has been considerable discussion as to whether one should practice lavage in cases of ulcer of the stomach. Here we ought to distinguish two different conditions; when you have to do only with simple erosions of the mucous membrane which give a black discoloration to the vomited matters, as is frequently the case in the gastritis of hard drinkers, lavage is indicated; when, however, you have to treat the round ulcer (ulcus-rotundum, of Cruveilhier) so frequently the cause of large hæmatemeses, you

should refrain from lavage unless indeed you are certain that all danger of hæmorrhage has ceased. It has, in fact, been a frequent experience to see grave hæmorrhages result from untimely lavage performed on patients affected with ulcer of the stomach.

The stomach tube has another useful office; it enables you to practice "gavage," or forced feeding. This word gavage was first applied by me to the method of Debove, and which consists in the introduction into the stomach, by the flexible tube, of nutritive mixtures. These alimentary mixtures have for their bases meat powders, and I shall finish this lecture by saying a few words about the mode of preparation of this kind of nutriment.

It is to Debove that therapeutics owes the introduction of meat powders, which were used during the Crimean war, and which our prime minister, Louvois, was one of the first to bring into use as a part of the dietary of the soldier. Since the first communication of Debove to the Society of the Hospitals, in 1882, the fabrication of these meat powders has acquired such an importance that to-day, in this city, it exceeds 300 kilogrammes per day. The processes of manufacture of different firms vary somewhat in detail, but all substantially agree in this, that the meat employed, whether horse-flesh or beef, is to be first dried at a temperature below 212° F., then reduced to an impalpable powder, and this is all there is in Adrian's process.

In an interesting comparative study of the different meat powders, Yvon has shown that almost all contain an equal quantity of available nitrogen, viz.: about 13 to 14 per cent. To remove the prejudicial odor which distinguishes these meat powders, especidlly when under decomposition, various processes have been tried. Rousseau washes them with alcohol, which frees them from fatty substances, and thus retards putrefaction; Yvon first cooks the meat a little, and he has shown that cooking does not in the least deprive the meat of its nutritive properties; Tanret prepares his meat powder in a similar way. But many persons prefer to make their own meat powder, and if you should be of their number, you can extemporize a good preparation in the following way: Take a certain quantity of boiled meat, cut it up in little pieces and dry it thoroughly by a water bath. Then grind the desiccated product in a coffee mill, of which the teeth are made to approximate as closely as possible. You thus get a powder which is somewhat coarser than that made by the pharmaceutical houses, but of an agreeable taste and which answers the purpose very well.

The meat powders of commerce ought to show muscular fibres under the microscope; they ought also to undergo peptonization with great facility. This peptonization, according to Yvon, corresponds to 70 or 74 per ct. of the weight of the powder.

Leaving to one side what pertains to the usage of

these powders in super-alimenation, I shall concern myself here only with their application to gastric and intestinal affections.

Whenever practitioners are in the habit of recommending raw meat as a restorative (and this valuable nutrient has been in great vogue everywhere since its uses were first pointed out by Weiss, of St. Petersburg). they should now substitute meat powders, the superior advantages of which are as follows: Greater nutritive value, the powder of meat corresponding to five times its weight of raw meat; much more ready peptonization by means of the pulverulent state; lastly, freedom from the danger of tænia, an evil which has often attended the ingestion of raw meats.

We have at various times attempted to mix divers farinas, as pea-flour, rice-flour, Indian-meal, with our meat powder; to-day these mixtures are pretty generally abandoned, as broths made in this way when taken hot have a very disagreeable odor, and it is found that the meat powder is much less offensive when administered cold. I am much in the habit of giving this nutritive powder in the form of milk punch, stirring two tablespoonsful of meat powder into a pint of old rum and milk, or whisky and milk (any good liquor can be substituted for the rum or whisky, and the quantity of the spirits can be varied at pleasure); the whole may be taken at once or at several draughts. This meat grog is especially applicable to the treatment of pulmonary tuberculosis;

in affections of the stomach you ought to use it sparingly on account of the alcohol in it. In gastric affections you may give the powder in plain milk or milk sweetened and flavored with vanilla, or you may give it in chocolate or prepared cocoa.

Lastly, when you use the stomach tube to practice gavage it will be sufficient to mix the meat powder directly with milk, but you should have care always to pour in a little milk at the end of the operation, in order to clear the tube of any meat particles which may cling to its sides to be left in the pharynx on withdrawal of the sound, and to annoy the patient by their disagreeable taste. I always make it a point to terminate each lavage by a gavage of milk and meat powder, and I have always obtained good results from this practice. This meat powder will not only render you service in cases of dyspepsia with anorexia, and in connection with your local medications of the gastric mucous membrane, but also in the treatment of diarrhœa, as we shall see in the next lecture when I come to speak of the new modes of treating intestinal diseases.

APPENDIX TO CHAPTER III.

LAVAGE AND GAVAGE.

[The operation of lavage of the stomach is coming into general use in diseases of that organ attended with dilatation and putrid dyspepsia, where frequent cleansing and disinfection of the gastric cavity is incated. Gavage, or forced feeding, which is also performed by the œsophageal tube, gives brilliant results in phthisical cases and certain anæmic conditions, where it is impossible sufficiently to nourish the patient by mouth, but where food of a proper kind when introduced into the stomach is well digested and assimilated. This is an operation which is now frequently performed in all the large hospitals, which are provided with stomach syphons, Debove tubes, etc., for the purpose. Many a private practitioner has also made lavage and gavage a part of his armament by which he combats disease.

The following extract from the work on "Diseases of the Stomach and Intestines" by Dujardin-Beaumetz, published, by Wm. Wood & Co. (Library Series, 1886, translated by E. P. Hurd) gives a more particular account of lavage and gavage of the stomach:

The idea of removing liquids from the stomach is of French origin, and must be credited to Casimir Renault. Another Frenchman, Blatin, in 1832, taught the utility of washings of the stomach. It must be

admitted, however, that it was Küssmaul who first systematized this practice and gave it a definite place among the resources of our profession.

It was in 1867 before the Congress of German physicians held at Frankfort on the Main, that Küssmaul first made known the results of his clinical experiments with the stomach tube. He employed the œsophageal sound, to which he adapted a suction and force syringe, and it was by virtue of this apparatus, called stomach pump, that liquids were injected into or withdrawn from the stomach. The inconveniences of this instrument were these: The introduction of a rigid tube was painful, moreover, the extremity of the sound irritated the walls of the stomach, so after several trials of Küssmaul's pump, I abandoned this method. But the discovery which Fancher made in 1879, and almost at the same time, Oser, in Germany, removed these difficulties.

This discovery consisted in the passage of a soft and flexible tube into the cavity of the stomach, and in the application of the physical theory of the syphon to the introduction into and removal of liquids from this organ. From this date I have multiplied the applications of the stomach syphon, and one of my pupils, Dr. Joseph Lafage, has comprised in his excellent thesis on the Treatment of Dilatation of the Stomach by Lavage, a great number of observations, and for ten years past I have so frequently practised stomach-washing, and with so much success, that I have had reason to felicitate myself on the part which I have taken.

How is lavage of the stomach performed? The answer to this question involves a description of the instrument used, the manner of using it, and the liquids employed for cleansing the stomach.

The tube Faucher is of flexible caoutchouc, one metre and a half long, with an index on one side, so that you may know the depth in centimetres to which the tube has penetrated. The tubes are of three sizes, Nos. 1, 2 and 3, the diameter of the first being eight millimetres, the second, ten millimetres, the third, twelve millimetres; to these tubes is attached a funnel.

In purchasing a tube Faucher, you should select one as smooth as possible and with some degree of stiffness, so that you may easily be able to make it enter the stomach by successive pushes (such tubes as Debove has recently caused to be made); as for the funnel, it should be made of glass, so that you may watch the descent of the liquid.

These tubes have lately undergone great improvements, without yet fully attaining the ideal of a hollow and resisting, yet quite supple tube. One of my colleagues, Audhoui, has constructed a stomach tube on the principle of the double catheter, (two flexible syphons glued together), while my friend Debove makes two parts of the syphon, and introduces the œsophageal part by the aid of a stylet, which gives stiffness and resistence to it. These improvements have not come into general use, in fact the simple tube may, by skilful management, give you all the results which you desire.

I advise you, when you attempt for the first time to introduce the syphon, to use tube No. 1 (taking care to select one with the requisite degree of stiffness); then, when your patient is used to a tube of this size, you can easily succeed with a larger one.

The introduction of this instrument can readily be effected in this manner: Place yourself in front of your patient. Make him open widely his mouth and protrude the tongue. Pass in the tube over the

back of the tongue, and when you have the extremity well in the throat, as far as the base of the tongue, make the patient swallow, and while the movements of deglutition are being performed, push on your instrument into the œsophagus. When once you have gained the first part of the œsophagus, you can easily carry onward the tube, by a succession of pushes, and with considerable rapidity.

Some have proposed to render the introduction of the tube easier by greasing it with oil, vaselin, or glycerin. Fatty substances leave a disagreeable taste in the mouth; I am myself in the habit of simply dipping the tube in Vichy water, or what is better still, in milk.

As soon as you have made the tube penetrate to the proper depth, as indicated by the salient index on the outside of the syphon, you annex the funnel, fill it rapidly with liquid; then as soon as you see the liquid disappear in the inferior portion of the funnel, you lower it instantly, converting the tube into a syphon, and causing the liquid contents of the stomach to flow into the pail which you have placed between the feet of the patient.

During the introduction of the tube some dyspnœa is manifested on the part of the patient. The eyes are injected, the face turns red, and the patient pretends that he cannot breathe. Insist, then, on the patient making full respiration during the operation.

To the dyspnœa we must add nausea and vomiting among the unpleasant accompaniments of the operation; this nausea is manifested as soon as the tube enters the œsophagus, or when it reaches the stomach. In some very sensitive individuals it is impossible to penetrate to the back of the throat without inducing vomiting. You can readily calm these

reflexes by bromide of potassium; in fact, it is my custom to give bromide internally, and apply it locally three or four days before attempting the first lavage of the stomach.

It is more difficult to avoid the irritation provoked by the presence of the tube in the stomach. The vomiting, however, which ensues from this cause, is more infrequent and can generally be prevented by introducing immediately into the gastric cavity a little water. In this way you will separate the walls of the stomach from the end of the tube and will avoid irritating the organ.

The tolerance of the pharynx, of the œsophagus, and of the stomach is readily obtained, and I can affirm that always after three or four sittings, patients support without any inconvenience the presence of the tube. In a very short time they can effect the introduction of the tube themselves, and in the case of the greater part of my patients, both in private practice and in the hospital, I leave to the patient himself, after the fourth sitting, the entire performance of the operation.

At the same time there are two circumstances which often present an insurmountable obstacle to the introduction of the syphon. These are, first of all, œsophageal spasms in certain hysterical females, spasms which it is often difficult to overcome, even with a rigid instrument; secondly, ulcerations of the epiglottis and the posterior part of the larynx, which frequently render the passage of the tube very painful. With the exception of cases of this sort and such mechanical obstacles as cancer of the œsophagus, I have never found patients rebellious to the introduction of the Faucher tube.

What kind of liquids and what quantities is it

advisable to introduce? Ordinarily we make use of some alkaline water, such as Vichy, or Vals; or it may be plain water, with one-half drachm to the quart of bicarbonate soda. I sometimes use, after the German practice, water containing one and one-half drachms to the quart of Glauber's salt.

In certain cases it is necessary not only to wash out the stomach, but also to disinfect it. In other cases it is necessary to alleviate cramps and pain seated in the stomach; in still other cases there are hæmorrhagic tendencies to combat; hence different medicated solutions are indicated.

Among the antiseptic liquids I particularize resorcin and boracic acid. Andeer is very fond of resorcin, and I have myself made numerous trials of this medicinal agent in chronic gastritis. Solutions of resorcin, as dilute as one per cent., are irritating, but they procure a complete disinfection of the contents of the stomach; therefore in using this medicament I take care to make the solution very weak (*i.e.*, not more than five grammes to the quart). Boracic acid in the same proportion is also an excellent disinfectant.

For the pain in the stomach the best solution to employ is the milk of bismuth. To a pint of water add five drachms of the sub-nitrate of bismuth; stir constantly before introducing this mixture into the stomach, and when you have caused it to enter the gastric cavity, let it remain there for several minutes, that the bismuth may have time to become deposited in thin layers over the mucous membrane. To the milk of bismuth you may add chloroform water and the carbon bisulphide water, solutions which are markedly anæsthetic to the gastric mucous membrane. As for the hæmorrhages, the best remedy with which

to combat them is a weak solution of perchloride of iron; a tablespoonful of the liquor fer. perchlorid. to the quart of water. All these constitute the topical applications or "dressings" on which you can best rely.

As for the quantity of liquid to use, this depends on the degree of dilatation and on the tolerance of the stomach. Some patients will bear two, three, four, and even five quarts; in the case of others a pint even will induce efforts at vomiting. You will then have to determine by trial the quantity which the patient will tolerate. However sensitive may be the patient's stomach, it is a good rule to continue the washing process till the liquid which issues from the buccal end of the syphon is perfectly limpid and clear.

There is generally little difficulty attending the removal of the liquid by the syphon; it is possible, however, that some solid particles of food in the stomach may get impacted in the eyes of the instrument so as to stop them up. You can generally clear these out by letting a little more liquid run through the tube into the stomach. In other cases (especially where there is great dilatation) your tube may bend on itself so that its lower extremity is applied to the upper part of the stomach; this may happen in ordinary practice from having introduced the sound too deeply. In these circumstances the syphon fails to work, for obvious reasons. You have only to withdraw the tube a few inches to overcome the bend and bring the open end in contact with the liquid. You can aid the evacuation of the stomach by pressure over the abdomen, and by making the patient cough, thus obtaining the expulsory contractions of the diaphragm.

Is the syphon sufficient in all cases of dilatation

of the stomach? Yes, in the immense majority of cases. When, however, the dilatation is enormous, and the stomach is full of putrid liquids, as sometimes happens in cancer of the pylorus, it is necessary, in order to effect thorough cleansing, to employ the stomach pump, which injects the detergent solution with more force, and enables it better to reach all parts of the stomach. I am in the habit of using the Collin pump in these circumstances, which is a good aspirating and force syringe, and is easy of adjustment.

To wash out the stomach and disinfect its contents, to apply suitable medicated dressings—such are the results which you may obtain from the syphon. But this is not all. You can by this method feed the patient, and practice what Debove calls super-alimentation, what Mesnet has denominated artificial alimentation, and what I designate under the common-place term, *gavage.*

It was Debove who first conceived the happy idea of applying the tube of Faucher to the alimentation of patients. The results which we have together obtained have stimulated us to continue our first essays, and since the first communication of Debove, in November, 1881, to the Medical Society of the Hospitals, this method has continued to undergo improvements.

Debove was the first, moreover, to make use of meat in the form of powder in this forced alimentation, and to obtain good results from this practice. Formerly we employed a mixture of raw meat and eggs, beat up in milk, but despite all the care that was taken in mincing this raw meat, the mixture was far from being homogenous, and quite often particles of meat in suspension would stop up the tube, and pre-

vent the further descent of the liquid food; and it was found necessary in these cases to use tubes of pretty large diameter. At the present day we get rid of these inconveniences by using alimentary powders.

Of what do these powders consist? They are of two kinds; powdered meat and farinaceous substances cooked and reduced to a fine powder. The powder of meat is obtained by drying the minced fibre of meat and raising the temperature to 100° C.; then reducing it to an extremely fine powder. At the present time, since our communications on the subject, a great number of manufacturers fabricate these meat powders, and you will find them in commerce under the denomination of powders of pure meat and powders of the fillet of beef. The first, which, are composed of horse flesh (a kind of meat, by the way, very nourishing), are of gray color, and their odor recalls that of duck's liver; these are the least expensive. The second, whose price is mnch higher, for it takes six kilogrammes of fresh meat to obtain one of the powder, are of reddish color, and have the odor of roast beef. Both are reduced to an almost impalpable powder, and it is this very finely pulverized condition which, by enabling each molecule of meat to be attacked on all sides by the gastric juice, explains to us how it has been possible with this method to cause such enormous quantities of these powders to be absorbed. We find in this fact a direct illustration of what I said to you in one of my previous chapters, in reference to the influence of the molecular state of bodies on their digestibility. We find also here another confirmation of the experiments of Schiff, which go to show that meat is one of the best peptogenous substances; in fact, under the influence of these powders of meat, you will see stomachs the most in-

active and feeble recover their functions and the appetite return.

The farinaceous powder consists of lentils, which furnish a flour of a very nourishing and highly azotized character. These farinas were originally used in their raw state, then Debove, having found that cooking augments their digestive properties, caused them to be cooked before being reduced to powder, and it is under this form of farina of cooked lentils that we generally administer it.

Tanret has advised to cause the lentils to germinate before using them, and Perret has made the powder out of malted lentils. Germination, in fact, favors in part the transformation of starchy matters, and in this way aids their digestion. You can in the same way utilize the farina of Indian corn, which is very rich in fatty materials, and the mixture of this powder with the powder of meat, either in equal proportions or in that of two parts of meat to one of farina, constitutes an alimentary product very acceptible to even the most fastidious patients.

These powders may be mixed in a variety of ways, as may be seen by consulting the thesis of my pupil, Robin.

In practicing forced feeding these alimentary powders are incorporated with water or milk, in the proportion of about 200 grammes (between six and seven ounces) to a quart of the vehicle. In mixing the ingredients, be careful to add the milk little by little, so as to make first of all a homogeneous paste with the powder, which slowly undergoes a solution in the milk as it is added, and you get in this way a liquid having the consistence and the aspect of chocolate, and which is ready for use.

You see, then, the advantages which these meat

powders have over the older preparations made from raw meat; they are much more nourishing in a smaller volume, and much more digestible, and there is no danger of conveying tænia through them to your patient. They are useful dietetic agents when stirred in thin tapioca gruel, or broth; one or two spoonfuls of powder of cooked beef, and a spoonful of farina of lentils, cooked or malted, or if you please, torrefied corn meal. Gruels made in this way are very agreeable to the taste, and are well borne.

These are not the only advantages of these powders. They have enabled me to simplify very much the operative procedure when it is desired only to practice artificial feeding, and when washing out the stomach may be omitted. We see, in fact, that while in the case of patients affected with severe gastric disorders, little or no opposition is made to the introduction of the tube Faucher, it is not so with persons not suffering from profound troubles of the digestion, but in whose case forced alimentation is deemed necessary. They are apt to be frightened at the size and length of the syphon, and to such an extent, that thus far the method of Débove has not been popular in the private practice of physicians, howevever successfully it has been employed in the hospitals.

I have therefore attempted to render the operation less painful, and this is the result of my endeavor: After having verified the fact first taught by Ortille, that in order to introduce liquid substances into the stomach all that is necessary is to place them in the upper part of the œsophagus, I have considerably shortened the tube Faucher, and I have given it a length of twenty centimetres only. Then since the alimentary mixture made with meat and farina is thin and diffluent enough to traverse quite narrow tubes,

I have diminished considerably the diameter of the tube, which is now only about the size of a large sized urethral sound. Lastly, I have flattened the pharyngeal extremity of the tube so as to render its introduction easier. A whalebone stylet keeps the tube curved, and a large disk placed at the buccal orifice (to keep the patient from swallowing the tube) completes the first part of the apparatus. The second part consists of a glass jar, in which I place the alimentary mixture, in the upper part of which reservoir air may be compressed by means of an India-rubber ball; a long India-rubber tube connects the œsophageal part of the instrument with the glass jar.

You proceed in this manner: With the œsophageal sound, furnished with its stylet, in your hand, you make your patient open widely his mouth, putting out his tongue, as if for a laryngoscopic examination; with the right hand you introduce the tube into the back part of the throat, and cause your patient to execute movements of deglutition, and you withdraw the stylet, taking care that the disk which terminates the tube shall come in front of the mouth; you then place the extremity of the free tube which is attached to the glass jar, into the pharyngeal sound. Then you compress the rubber ball and the alimentary mixture passes from the reservoir into the œsophagus of the patient; you ask him to make efforts to swallow, and slowly and progressively you cause the liquid in the glass reservoir to penetrate the stomach.

You have often seen me perform this operation in our hospital; you have seen the readiness with which patients consent to be fed in this way, and how much they prefer this method to the former, in which the longer and larger tube is used.

Thanks to gavage we see the appetite return, the

bodily weight increase, the strength come back, and the facts which Debove has published, and those which I have noted, indicate the great future in reserve for this kind of treatment, which is applicable to all cases where nutrition is at fault, and especially to tuberculosis.—Trans.]

CHAPTER IV.

NEW GASTRO-INTESTINAL MEDICATIONS.

In the last lecture I spoke of the new gastric medications. I wish now to complete the subject by telling you of the new gains made by therapeutics the last few years in the treatment of gastro-intestinal affections, and I propose to call your attention particularly to the following points: 1. The application of electricity to the treatment of diseases of the stomach and intestines. 2. To enteroclism. 3. To alimentary lavements. 4. To anæsthesia by the rectum. 5. Lastly to a new remedy said to be curative of hæmorrhoids, the *Hamamelis Virginica.*

The applications of electricity to the treatment of gastro-intestinal affections have been multiplied during the last few years, and we have to consider the subject in its relation to the stomach affections on the one hand, and to the intestinal on the other.

For persistent, uncontrollable vomiting and acute gastralgic pains, Apostoli, repeating the first tentatives made in 1861 by Prof. Semmola, of Naples, has proposed to employ constant currents.* He practises in these cases what he calls "positive polar galvanization

*Apostoli. On the new treatment by electricity of the epigastric pain and the gastric troubles of hysteria (vomiting, gastralgia). Bull. de Ther., 1832 t. ciii, p. 410. Semmola, see Gubler's Journal de Therapeutique, Oct. 25th, 1878.

of one or both pneumogastric nerves. This is the mode of procedure: Place the positive electrode outside of the inner extremity of the clavicle just grazing the upper side of the bone, and over a point marked by the depression left by the interval between the two inferior fasciculated heads of the sterno-mastoid. This electrode is constituted by a beak-shaped carbon point, covered with chamois leather, which is moistened before being used. The other electrode consists of a roller which the patient holds in his hand; the battery is the Gaiffe or Trouvé apparatus with constant current.

As for the quantity or dose of electricity, this is variable, and oscillates between 5 and 15 milliamperes, and ought to be such that under its influence the epigastric pain disappears.

The duration of the séance ought to be sufficient to effect disappearance of all pain and spasm. It averages from ten to twenty minutes, but may be prolonged much beyond this. To combat the vomiting, Dr. Apostoli recommends as of prime importance to begin the galvanization when the stomach is empty, then to make the patient eat during the galvanization, and to continue the latter until all vomiting has stopped.

I have often employed this method in my hospital service and in private practice, and I have sometimes obtained from it good results, especially in the multiple manifestations, so well described by my pupil Dr. Lucien Deniau, in his thesis on Gastric Hysteria.

Moreover, this process presents no danger, it is not complicated, and may be had recourse to without any inconvenience.

But electro-therapeutists have gone farther in this direction, and have proposed to carry the electrical current to the interior of the gastric cavity. Fürstner and Heftel, Macaria and Bonnefin had already employed weak induced and intermittent currents to arouse the contractility of the stomach. Perli, in 1879, applied this induced electricity to the interior of the stomach by means of a conductor introduced in an œsophageal sound, and he counselled this faradization in the treatment of dilatation and chronic catarrh of the stomach.* Baldrino Bocci† in 1881 repeated the experiments of Perli, and always with faradic currents. Our laboratory chief, Dr. Bardet, to whom we owe an excellent treatise on Medical Electricity, uses constant currents, and practices direct galvanization of the stomach. I here place before you the instrument constructed after Bardet's plan by Galante, and which we make use of in our hospital.

It is, as you see, a stomach syphon tube in which, by an ingenious mechanism, is inserted an electrode constituted by a thin copper stylet terminated at its inferior extremity by an olive-shaped carbon point. This inferior extremity never passes beyond the ex-

* Perli, el Morgaghi, May, 1878.

† Bocci, lo Spermientale, June, 1881.

tremity of the rubber sound, and cannot come into direct contact with the mucous membrane of the stomach. This is the manner of procedure, and I am going to practice direct galvanization before you.

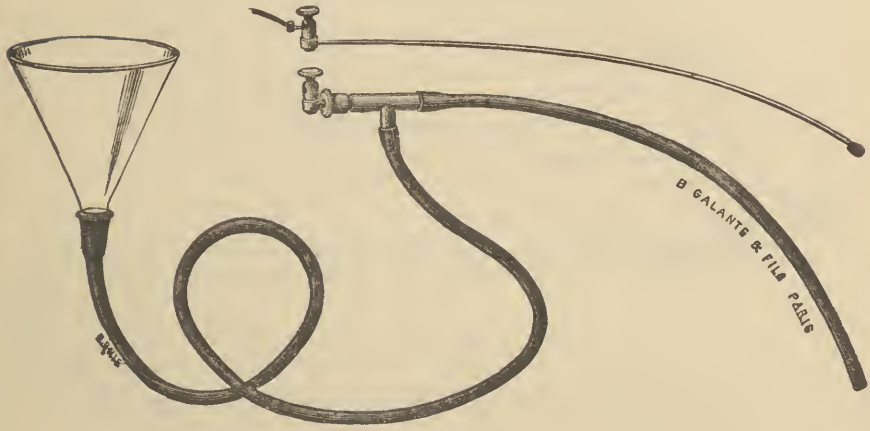

Fig. 1.

You introduce the syphon without the electrode; when once in the stomach, you pass in the stylet. You then fill the stomach with water, and lastly, place one of the electrodes either in the hand, or over the stomach of the patient, while the other is fixed to the superior extremity of the stylet. As for the current which you are to use in these cases, it varies according to the indications which you have to fulfil. If it be a case of dilatation of the stomach, and you want

to stimulate the contractions of the muscular coat, it is the negative electrode which you should introduce into the stomach, and you should then make use of the galvanic current with slow interruptions; and to regulate these interruptions we employ here, as you may see, a metronome constructed for this purpose by Gaiffe. If, on the other hand, it be a case of vomiting you wish to combat, it is the positive pole which you introduce into the stomach, and you will employ constant currents.

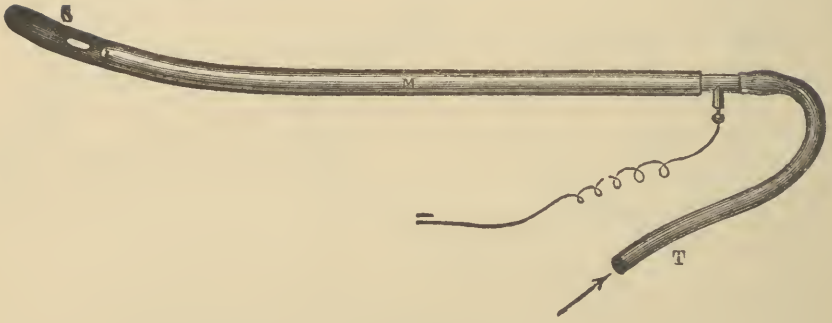

Fig. 2.

But whether you use positive or negative currents, it is always by the intermediation of the water contained in the stomach that electrization of the walls of this organ is effected. As for the intensity of the current, this varies between 15 and 20 milliamperes. You have been enabled to see the benefits which are derived in certain cases of gastrectasis or

of nervous vomiting from this direct galvanization of the stomach.

But there is a morbid condition where the results obtained by electricity are still more remarkable and more positive; I refer to intestinal occlusion. Applied for the first time by Leroy, of Etiolles, in 1826, under form of faradization, the electrical treatment of internal strangulation had been attended with considerable success, and in this connection I ought particularly to signalize the brilliant results obtained by our colleague in this hospital, Dr. Bucquoy,* but it is Dr. Boudet, of Paris, who still more recently (in 1880) established the mechanical basis of this application of electricity to the intestinal affection under consideration.†

He employs galvanization and makes use of the electrical excitator such as I here show you (Fig. 2); an excitator in which the electrode can never be in direct contact with the rectal mucosa. It is the negative pole which should be introduced into the intestine; the positive electrode should be placed over the abdominal wall. The currents must be of feeble intensity, and must not exceed 10 to 15 milliamperes. It is necessary to be careful from time to time to interrupt

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* Bucquoy, Practical Considerations on the Treatment of Intestinal Strangulation.—(Journal de Therapeutique de Gulber. 1878.)

† Boudet on "Two Cases of Intestinal Occlusion, Treated and Cured by Electricity."

the constant current by pressing upon the interrupter with which the galvanic batteries are furnished. The séances should be of variable duration, and repeated three or four times a day, according to the urgency of the case, and should last on an average twenty to thirty minutes.

Dr. Boudet has modified the rectal excitator, and basing himself on the good results which I had obtained in certain cases of intestinal strangulation by the use of the Débove tube, he has utilized in galvanizing the intestine the same apparatus which he employs in galvanizing the stomach. You see here this rectal excitator, and you readily understand its mechanism. An air cushion through which it passes enables one to keep it firmly in place.

It is especially in cases of ileus or volvulus, and in the pseudo strangulations due to paralysis of the muscular fibres of the intestine, that electricity will give you the best results, while it is absolutely without efficacy when the case is one of compression of the intestine by tumors, or of strangulation by peritoneal bands.

When you have to do with strangulation by compression of the intestine, or by degeneration of that viscus, you can employ another method recommended by Cantani, of Naples, under the name of *enteroclism*. The apparatus which serves for the practice of enteroclism is very simple, and consists of a metallic reservoir or fountain, furnished with a stop-cock connected

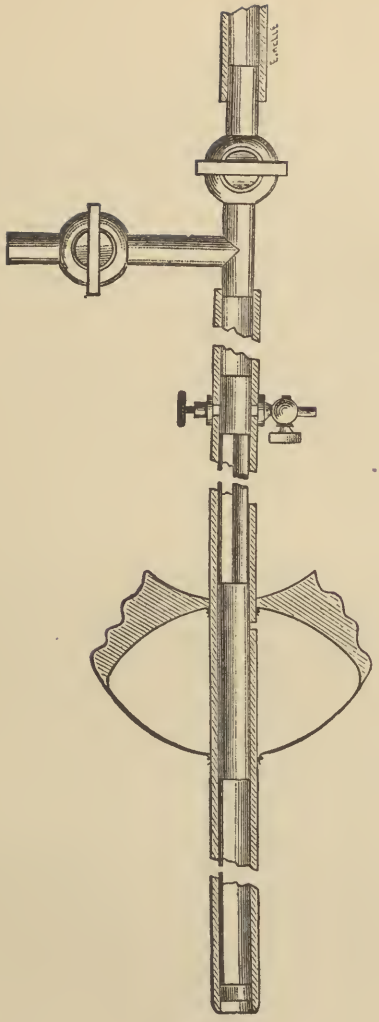

FIG. 3.

with a long rubber tube ending in a canula, which is placed in the rectum, and. according to the height to which you raise the fountain, you have a more or less energetic current. Cantani has maintained that one may in this way cause certain fluids, such as oil, to penetrate the whole length of the intestine, and even pass the ilio-cœcal valve, so that the oil introduced by the rectum shall be vomited by the mouth. He has utilized his method not only in the treatment of strangulation, but even in the performance of topical applications necessitated by affections of the intestinal mucosa, and Paolucci, Pera, Perli, and more recently, Muselli, have shown all the advantages of this method.*

I have myself perfected this method by demonstrating that the best enteroclist is the Debove tube, which, owing to its suppleness as well as its rigidity, may be made to penetrate to a great height in the intestine; and, on the other hand, by means of the syphon, you are enabled to vary at will the intensity of the current by elevating or lowering the funnel. You should, however, for such purposes, select a tube whose inferior extremity is provided with but one opening, which should be relatively small, so as to augment the force of the jet. I have been able by this means to interfere to advantage in cases of com-

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* Muselli, On Enteroclism (Gaz. Med. de Bordeaux, 1883).

pression of the intestine by abdominal tumors, and even in cases of degenerative disease of the bowel, but you can also make good use of this method in the introduction of alimentary lavements.

This question of alimentary lavements is to-day entirely settled. We know now with a measure of exactness by the experiments of Albertoni, of Garland, of Maxwald, of Czerny, and Latschenberger, that the large intestine and its inferior extremity are destitute of all power of digestion, and that they have only a rôle of absorption, and the recent experiments of Goldschmidt have not modified this view. It is necessary, then, as I have shown, and as my pupil, Chevalier*, has pointed out in his thesis, that the lavements, to be nourishing, shall contain peptonized substances, and we have here one of the most useful applications of the peptones.

During the International Congress of Medicine held at Amsterdam, I had an opportunity to observe the manufacture of these peptones, which, owing to the labors of Saunders, are so much in use in that country. On my return, and in accordance with my directions, M. Catillon set himself to the task, and to-day the fabrication of peptones has become a settled branch of industry among us.

These peptones appear in commerce in two states:

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* Chevalier, on Alimentation by the Rectum, Thesè de Doctoret, 1879.

the one solid, and the other liquid. You should in most cases select the dry in preference to the liquid peptones; moreover, according to the method of fabrication employed, they are either acid or neutral. But whatever improvements have been made in the process of manufacture, these peptones have, nevertheless, a taste of raw glue, which renders them disagreeable to take by the mouth; and, since meat powders have come into vogue, the usage of peptones by the stomach has been almost completely abandoned. They render us, on the contrary, immense service in alimentation by the rectum.

It is necessary to carry these lavements as high up as possible in the intestine, and it is here that the Debove tube, or the enteroclist instrument may render us good service. These lavements ought always to be kept up, and one should take care to cleanse the rectum by a copious injection of water before the introduction of the nutrient clyster. The following is a form of alimentary lavement which I frequently order:

Into a cup of milk stir the following substances: The yolk of one egg, two dessert spoonsful of dry peptones, five drops of landanum, and if the peptones are acid, add to the lavement seven or eight grains of bicarbonate of sodium; if your peptones are liquid, the quantity will be two tablespoonsful. You will give one such lavement night and morning.

By means of these lavements you can, as Catillon

and Daremberg have shown, maintain nutrition for months, on condition only that under their influence no irritation of the rectum sets in. I cannot too much recommend these peptonized lavements which constitute the only means of supporting life by the rectum.

Lastly, it has been quite recently proposed to utilize the absorbent properties of the rectal mucosa for the practice of anæsthesia, and it was Dr. Molliere, of Lyons, who introduced this new mode of anæsthesia, thus going back to a process already put in usage in 1847 by Pirogoff, of St. Petersburg, and by Simonin in 1849, who was the first to employ it in France at the Clinic of Nancy.

The method of application is very simple. In a graduated flask you place a certain quantity of ether; this flask is terminated by a rubber tube, the size of the little finger, which is introduced into the anus, and to set free the vapor of ether, it is sufficient to dip the flask into a sea-bath at 50° C. (122° F.)

Since this method of anæsthesia has been revived, we have seen it tried in France and abroad with variable results; some affirming that it is the very best method of surgical anæsthesia, others, that it is often inefficacious and even dangerous. I believe, without however being able to decide this question, which belongs rather to the domain of clinical surgery than to that of medical therapeutics, that anæsthesia by the rectum will always present this serious drawback, that it is difficult to appreciate the absorbing power of the

mucous membrane of the large intestine, and that, according to variable circnmstances, this absorption may be very rapid and hence very active, or very slow and for that reason almost *nil.* In the first event, the absorption will be too great and may possibly entail accidents such as were observed by Dr. Delore. In the other event, on the contrary, the anæsthesia will always be incomplete, and this is what happened to several surgeons, and particularly to Dr. Follet, of Lille. However this may be, you should always have in mind the possibility of anæsthesia by the rectum in the case of certain operations, and in particular those that are practiced on the face.

It remains for me to finish this short lecture by a brief consideration of a medicament very much vaunted in America and in England for the cure of hæmorrhoids; I refer to the *Hamamelis Virginica.*

From time immemorial the native Indians of the United States have made use of a shrub that grows in abundance in marshy lands in the Eastern States and along the Mississippi, and which goes by the name of *witch-hazel.* The young shoots serve for divining rods, to indicate veins of water or of the precious metals, and in which the ignorant have faith. This shrub belongs to a botanical family to which has been given the name of Hamamelaceæ because it bears at the same time flowers and fruit (ἅμα, at the same time, and μῆλον, fruit), and is the botanical species mentioned above.

The first mention of hamamelis is found in the dictionary of Merat and Delens, published in 1831. According to these authorities, Bollinson introduced this shrub into Europe in 1736. These facts were quite forgotten, for it is not till the last few years that the therapeutic action of hamamelis has been studied, and it is by the homœopathic physicians principally that attention was first called to the curative virtues of this plant. Thus it was Hughes in 1874, and Hale in 1879, who were the first to point out the hæmostatic and calmative action of witch-hazel.

In France it is to Dr. Serrand in 1881, and Dr. Tyson in 1883, that we owe the new awakening of interest in hamamelis, and I ought to mention in this connection a recent treatise on this subject, published in Belgium by Dr. Vanderespt. One of my pupils, Dr. Guy, has, moreover, devoted his inaugural thesis to the study of this plant, and you will find there embodied the researches which have been undertaken in this hospital, both in our laboratory and in our clinical wards.*

Despite the painstaking of our chemical researches and the repeated analyses of our pupil, M. Mougin, we have been unable to find any alkaloid in this plant, which seems to contain only tannin, an essential oil, a waxy matter, and divers extractive substances. As for the pharmaceutical preparations, the most popular

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* Guy, Thèse de Paris, 1884.

in America and in England is a fluid extract. This preparation is nothing but a hydro-alcoholat, or spirit, having a strong and disagreeable odor; so when patients find it impossible to take this fluid extract on account of the smell, you can employ the following potion:

Take of Fl. Ext. Hamamelis,
Syrup Aurantii Corticis, ää ℥ ij.
Spts. Vanilla, gtt. xxv.
M. Sig.—Take a teaspoonful as often as required.

We make use in France of an alcoholic tincture of the leaves and of the bark, which is given in the dose of from 5 to 25 drops several times a day. Finally, Petit has made a dry extract of hamamelis, which you may give in pills of two grains each. For external use, you may make use of ointments or lotions with the different solid or fluid preparations.

As for the doses, they may be pretty large; never in fact, in experiments on animals, whatever may have been the dose administered, have we obtained any toxic effect—I may even say any physiological effect. It was important, in fact, to know whether this hamamelis, which was credited with such active properties on the circulation and on that of the veins in particular, manifests this action on animals. In regard to this, we have observed nothing; I ought, however from the point of view of toxic action, to mention certain cerebral symptoms of some gravity which Dr. Campardon says that he observed during the usage of ham-

amelis. There would seem to be some mistake here, for never have any such symptoms been observed in America where such free use is made of the extract.

I have employed hamamelis, as the Americans have advised, in the treatment of hæmorrhoids, and even of varices. In the case of hæmorrhoids I have obtained, in a few instances, a very marked action, which has consisted principally in the diminution in size of these piles, and in the disappearance of the sensation of weight and pain which accompanied them. The dose which I have administered is a teaspoonful of the fluid extract five times a day, or 10 drops of the tincture. These doses have given me no results in the treatment of varices, and whatever Dr. Musser may have said, I believe that hamamelis is absolutely inefficacious in such cases.

Finally, I ought to remind you that Serrand has locally employed the preparations of hamamelis in congestive affections of the larynx and pharynx. To sum up: Hamamelis is, as you see, a medicament of little activity, but which you can utilize in cases of hæmorrhoids, especially when complicated with pain.

In conclusion, it remains for me to finish what pertains to new gastro-intestinal medications by speaking to you of antiseptic intestinal medication, but this is a subject which has undergone great developments, and to which I intend to devote the next lecture.

CHAPTER V.

ANTISEPTIC INTESTINAL MEDICATION.

Pathologists have long suspected that in a certain number of infectious diseases, the fermenting contents of the intestines, and putrescent fæcal matters, may have a preponderant rôle, and this view has been especially entertained respecting the pathogeny of typhoid fever. In fact, in this disease the contagious principle has long been located in the dejections. But the discovery on the one hand of the alkaloids of putrefaction, and the attentive study of micro-organisms on the other hand, have given us a clearer insight into this pathological question and established on scientific bases an antiseptic intestinal medication. Before describing the agents of this medication, I have something of importance to say concerning the examination of intestinal matters from the point of view of putridity, and concerning physiological experiments which have been made to elucidate this subject.

The existence of putrid fermentation taking place in the contents of the intestines is proved by: (1) The presence of certain micro-organisms; (2) certain cadaveric alkaloids; (3) finally, certain special products, such as indol and skatol, which originate in modifications undergone by albuminoid matters.

(1) As Netter has remarked in his able re-

view of the chemical poisons which the organism produces, it is to Leuwenhöeck that we must ascribe the discovery of the micro-organisms contained in fæcal matters. This early microscopist noted the presence in fæces of animalcules, similar to the anguillulæ of vinegar, but of infinitely smaller dimensions. Since then all these organisms have been classified, and micro-biologists have described multitudes of all varieties and species. These micro-organisms have several origins; they are derived from food which contains a prodigious quantity; they exist also in the air which we breathe, which contains innumerable microbes, as the curious researches of Miquel have shown.

This air, it may be said, does not penetrate into the intestine; this is true, but it filters through the anfractuosities or the nasal fossæ and the pharynx, and these micro-organisms, retained in these points by the secretions of the mucous membranes, easily gain the digestive tube.

It is in this way, I believe, that is explained the diarrhœa so frequently provoked by prolonged sojourn in our post-mortem and dissection rooms.

Miquel has, in fact, shown us that the number of microbes varies considerably according to different places, and that between the air which one breathes from the top of the Pantheon, and that of our hospital wards, there is a great difference as regards the quantity of contained micro-organisms.

To those microbes introduced by aliments, and those which filter through the nasal and oro-pharyngeal passages in the inspired air, we must add those which develop in the digestive tube itself; and here in this connection, I must again refer to the curious experiments of Miquel, who, searching with all the rigor of Pasteur's culture processes to find what were the points of the economy which might promote the development of bacteria in nutrient culture liquids, showed, what one might have anticipated, that the lungs and the digestive tube are the only organs capable of determining a culture of microbes.

As for the digestive tube, the activity of the cultures is much greater the farther you get from the stomach, and the nearer you approach the inferior extremity of the alimentary canal. Hence, then, from all that goes before, it remains settled that in the physiological and pathological state, fæcal matters and the contents of the intestine contain a great quantity of proto-organisms.

Passing now to the alkaloids of putrefaction, since the researches of Selmi, which go back to 1872, you know that the name *ptomaines* has been given to certain alkaloids derived from bodies undergoing putrefaction.

These ptomaines are found in considerable abundance in fæcal matters, and their origin, as well as the part which they perform in the economy, merits attention.

The idea which Selmi had conceived of attributing to putrefaction the production of the ptomaines which he observed, is not absolutely exact, and it seems demonstrated that certain animal alkaloids can be generated apart from putrefaction; the experiments of Prof. Armand Gautier are, in this respect, very convincing.

Before Selmi, Gautier had already shown that these alkaloids might come from. modifications which are undergone by albuminoid matters apart from putrefaction; so, generalizing from this fact, he considers the alkaloids of animal origin as one of the physiological products of the living cells; and just as the vegetable cell makes alkaloids, such as quinine, strychnine, etc., the organic cell also produces similar principles, to which Gautier gave the name of *leucomaines*.

Moreover, Tanret, in 1882, called our attention to this important point, which quite confirms Gautier's views, viz.: That the peptones give most of the reactions of the alkaloids.

Brieger has completed these researches in directly obtaining an alkaloid by the action of gastric juice on fibrin. In fine, it has been ably maintained that the micro-organisms may produce alkaloids varying according to the species of microbes observed.

To sum up, it is seen then that fæcal matters contain organic alkaloids having a quadruple origin; they may result from the putrefaction of absorbed

albuminoid substances; they may take their source in alkaloids furnished by the living organism, according to the theory of Gautier; they may be due to the action of gastric juice on fibrin, according to Tanret's experiments; in fine, they may be the result of the presence of micro-organisms, which, as we have said before, exist in so great quantity in the digestive tube. We know by accurate physiological experiments the action of these ptomaines or leucomaines; we know that they determine in the living organism symptoms quite analogous to those that are produced by muscarine. They are veritable poisons of the heart, and you see developed in animals to which they are administered convulsive troubles and pupillary modifications.

In fine, there exist in intestinal matters products derived from fermentation: leucin, tyrosin, stercorin, excretin, indol, skatol, phenol, etc. If it be true, as Kühne has pointed out, that the two first of these bodies, tyrosin and leucin, may be produced apart from putrefaction by the action of one of the ferments of the pancreatic juice, trypsin; if stercorin and its derivatives take their origin in modifications undergone by the bile; indol, phenol, and skatol result, on the contrary, from putrefaction of nitrogenized substances introduced in the intestines.

So, then, it seems to be established on unquestionable scientific bases, that, in the physiological state, the intestinal contents include micro-

organisms, organic alkaloids, and all the derivatives which result from the putrefaction of albuminoid substances.

More than this may be affirmed; and Prof. Bouchard, who was one of the first to attribute to all these phenomena their true semeiological value, has shown that these putrescible substances may in certain circumstances not merely fail to be eliminated in the fæcal matters but even penetrate the economy by the vast field of absorption which the intestinal mucous membranes afford them, and thereupon determine a symptomatic aggregate tolerably well defined, and very similar to what one observes in the different forms of anæmia, and to which he has given the name of stercoræmia.

From all the above we can draw this important conclusion: That man in the physiological state necessarily produces poisons, more or less virulent, and that the condition of health for him consists in their regular and rapid elimination by the different emunctories of the economy, and particularly by the kidneys and intestines; nor must I omit to mention the liver, which has for its function the destroying of a certain number of these toxic alkaloids. But let some circumstance come to interrupt this equilibrium —let the liver cease its functions; let the glomeruli of the kidneys become obliterated; let too active an absorption take place from the intestines, whether by abnormal shedding of its epithelium, or by the pres-

ence of ulcerations, or by want of power on the part of the digestive ferments sufficiently to stay the production of phenomena of putridity—in all these cases there may ensue a pathological state for the relief of which we may be called upon to render assistance.

Humbert had already, in 1873, pointed out in his thesis the importance of these septicæmias, but it is to Bouchard that the credit belongs of having brought all these facts together into a pathological unity.

The physician can, and ought to, interfere to combat these intestinal septicæmias, and he attains this end in employing two kinds of medicaments: One kind which has for its object to prevent putrid fermentations from developing in the digestive tube, and to destroy the toxic elements which are found there; another which has for its end the favoring of the rapid elimination of these matters from the intestines. Let us examine each of these indications, and the medicinal agents designed to fulfil them, commencing with the last:

The indication to eliminate the toxic matters found in the digestive tube, and to favor their speedy issue, is fulfilled by purgation. I need not here occupy much time with the general subject of purgatives. I cannot, however, forbear remarking how strikingly the interesting researches on the putrid fermentations of the intestines harmonize with and justify the traditional medication of our fathers.

Substitute, in fact, for the words *peccant humors*, *atro-biliary humors*, the words *micro-organisms*, *alkaloids of putrefaction*, and you will understand the importance which the physician of the olden times attached to this group of medicaments, and you will better appreciate the language of the physicians of Molière's time, whose very phraseology the immortal comedian has transmitted to us in his *Malade Imaginaire*. It was not then to expedite from the system the bad humors of Monsieur Orgon that Fleurant employed the numerous apozemes prescribed by Purgon, but really (in modern language) to expel the putrid elements which had developed there.

The group of purgatives already so numerous, has been enriched in the last few years by a vegetable substance with which we have experimented in our service, and which seems to possess a real efficacy. I allude to cascara sagrada, very much vaunted in America.

The cascara sagrada, or, to speak more scientifically, the *Rhamnus purshiana*, is a shrub which grows in abundance on the borders of the Pacific in North America, and belongs to the family of Rhamnaceæ, which has already furnished medicine with an energetic purgative, the buckthorn (*Rhamnus catharticus*).

It was Bundy who, in 1878, first pointed out the purgative properties of the *Rhamnus purshiana*, and Landowski was the first to introduce it into France.

The part employed is the bark, which contains

different resins, which give to it its purgative action. This medicament is administered under two forms. The Americans employ chiefly a fluid extract in the dose of thirty to forty drops. In France we use especially the powdered bark put up in the form of capsules, each containing about four grains. This dose generally suffices to produce one regular stool every day; when it is insufficient, you can administer one capsule in the morning and another in the evening. The purgative effects thus obtained are quite satisfactory; and I believe, that this new medicine deserves a place in therapeutics between podophyllin and rhubarb as a remedy in habitual constipation.

Passing now to the true intestinal medication, *i.e.*, to the medicinal agents which are capable of modifying the putridity of intestinal matters, we find that these substances may be introduced by two channels:— Either directly into the intestines by means of enemata, or; indirectly by the mouth. The antiseptic or aseptic substances which can be introduced directly into the intestine by way of enemata, are not very numerous, and this is on account of the irritant and toxic action of most of them. The dangers which attend the free use of carbolic acid are well known, and to avoid such risks we are obliged to employ substances which are but slightly irritating and toxic, such as salicylic acid (unfortunately little soluble), boric acid, and cupric sulphate. But the lavements which succeed the best

in such cases are those which Bouchard has long recommended, and which consist simply of water in which a certain quantity of pulverized charcoal is suspended. For these lavements charcoal from poplar wood, prepared according to the directions of Belloc, is superior to any other; it forms in fact with water an almost homogeneous mixture. You suspend, then, in six ounces of water, two or three tablespoonsful of Belloc's charcoal powder, and administer the whole as an enema to the patient.

These injections have no toxic effect and they disinfect perfectly the contents of the large intestine. Their action is, however, local and extremely limited, so that when you desire to practise antiseptic intestinal medication thoroughly, you should endeavor to disinfect the entire intestinal tract, and for that purpose medicinal substances should be introduced by the mouth.

Among the medicaments worthy of being advised for this object, there are three to which I desire to call attention, namely; charcoal powder, iodoform, and carbon-bisulphide water. We have here again powdered charcoal, which is a good medicament, but which is attended with several disadvantages, such as the necessity of taking large quantities to obtain a sufficient disinfectant action, and the fact that this substance, which certainly will deprive the stools of their bad odor, does not destroy the organized germs which are there.

Iodoform in this respect is much more active; it is not only a disinfectant, but also powerfully aseptic. Unfortunately, it presents the dlsadvantage of being an active and irritant medicament. Whenever I have had recourse to it, whether in the form of granules, or in capsules (containing iodoform dissolved in ether), I have produced a speedy irritation of the stomach if I have desired to prolong the action of the medicament. Therefore, I much prefer the carbon-bisulphide water, which I have employed with so much success in our hospital wards.

I give the name of carbon-bisulphide water to the solution by agitation of this chemical in water. We thus obtain a liquid possessing a strong odor of carbon bisulphide, and containing a quantity of the latter concerning which authorities are not agreed; while Peligot fixes it at one drachm per quart, Kiandi-Bey thinks the proportion only one-fourth as much.

This solution has a rather agreeable taste, and leaves a cool, fresh sensation in the mouth; mixed with milk or with wine and water, the taste almost entirely disappears. Allowed to stand in any receptacle, this water loses little by little, by volatilization of its bisulphide of carbon, its taste, its smell and its properties; therefore, it is always necessary, in order to keep the solution of the same strength, to have a little undissolved bisulphide of carbon in the flask.

This is our formula for this solution:

℞ Carbon bisulphide, 20 grammes.
Water, 500 grammes.
Spts. peppermint, gtt. xxx.

M.

Put into a flash of the capacity of seven hundred grammes, shake and let the mixture settle. Eight, ten, or more tablespoonsful of this water should be given per day, care being taken to pour each spoonful into a half tumblerful of wine and water, or of milk; the patient should be recommended also to replace with fresh water the water in the flask as fast as it disappears by use. I add, to finish what pertains to this pharmaceutical preparation, that bisulphide of carbon is of moderate price, so that this solution is quite cheap, costing only a few cents per litre. I come now to the physiological and therapeutical properties of carbon bisulphide water.

It is a matter of history that, since the writings of Delpech, who attributed violent toxic properties to this medicament, carbon bisulphide was considered a dangerous medicament. We feared its action on the nervous system, *i. e.*, the paralysis (partial or general), the impotence, etc., which were ascribed to its use. External applications were, indeed, made in the case of wounds of a bad condition, and Guillaumet wrote an able paper on this use of the remedy. So when I commenced my researches on the bisulphide of carbon, it needed the reiterated assurance of M. Kiandi Bey, who told me of the great chemical works in France

and elsewhere where they manufactured bisulphide of carbon, and the two thousand operatives constantly employed in these works, none of whom ever experienced the least symptoms of poisoning from freely handling this substance and breathing its gaseous emanations—it took all this to decide me to make trial of it in my hospital practice. The experiments which I have made on animals with my excellent interne Sapelier, who has devoted his inaugural thesis to this topic, promptly convinced me of the innocuousness of bisulphide of carbon, and since then I have constantly used the carbon-bisulphide solution in the treatment of infectious diseases. By means of this water the stools are disinfected perfectly, and the noxious germs which they contain are destroyed, and under the influence of this treatment the infectious diarrhœas disappear. I have also found this medication of benefit in putrid dyspepsia with dilatation of the stomach. For more than six months I have been giving this carbon-bisulphide water in typhoid fevers, in doses of from 5 to 10 tablespoonsful a day, according to the intensity of the diarrhœa, and I have obtained most satisfactory results from the point of view of intestinal antisepsis. Nor have I seen any untoward accident from its employment. It is understood that the sulphide of carbon has no action except in relation to the putrid phenomena taking place in the intestine, and that it can in no other way modify the course of typhoid fever, which is a general

disease, of which the intestinal troubles are only one phase. But in addressing itself to this one marked feature of the disease, and in favorably modifying putrescent intestinal processes, carbon bisulphide has been proved to be possessed of efficacy above all other medicaments.

I shall complete the subject by another lecture on Antiseptic Medication in General.

CHAPTER VI.

ANTISEPTIC MEDICATION IN GENERAL.

I desire in the present chapter to bestow some consideration to the subject of antiseptic medication in general. Already, in the foregoing chapter, we have been occupied with antiseptic intestinal medication, and I wish to show you that this question of antiseptic medication is of much wider application, that it has a great future in store for it, and that modern therapeutics is even dominated by it.

It is to our illustrious countryman, Pasteur, that we owe this real medical revolution, for in showing us the living nature of contagion, he has also pointed out to us the new course that therapeutics must henceforth pursue. The proposition formulated by Bouley: "Every virulent disease is the function of some microbe," tends more and more to find its verification and to overpass the bounds first assigned to it, for we to-day see pneumonia lay claim to microbiotic origin. Pasteur's merit does not so much consist in his discovery of the living nature of contagion, as in the processes which he has put in usage for the cultivation of the virulent principle, and in the means which he has employed for the attenuation of their noxious properties, so as thus to constitute attenuated viruses which preserve man from fresh attacks of the disease.

I do not intend here to sketch the history of these

attenuated viruses—veritable new vaccines—but I desire to give you some instructions concerning the medicaments at our disposal to destroy the micro-organisms by which we are surrounded.

The atmosphere, as you know, contains microbes in great numbers, and one may even affirm that the salubrity of the air is in direct relation with the quantity of these micro-organisms. Are they very numerous? the air is unwholesome. Are they, on the other hand, very few? the air is regarded as wholesome. Do not think that these are theoretical notions, for experience is every day confirming their reality; thanks, moreover, to the ingenious processes devised by Marié Davy, and Miquel, we are able to determine with almost mathematical accuracy the number of micro-organisms flitting in the air. Consult in this regard the interesting Annuals of the Observatory of Montsouris, for the year 1882 and 1883, and you will find statistics of the greatest interest.

While at the summit of Mount Blanc the air is, as a rule, free from microbes; in our cities, on the contrary, they abound, and their number varies according to localities. Thus, in the park at Montsouris only 51 microbes to the cubic metre are found; in the streets of Rivoli, on the other hand, the number is increased to 680, and they are still more numerous in the confined air of our apartments and our hospital wards. In a bed chamber in the street Monge they have been known to attain the figure of

5,260 per cubic metre; but it is in our hospital wards that the proportion is the greatest, and there we see them exceed the figure of 28,000 per cubic metre; in the Lisfrane ward, for example, at the hospital Pitié. These figures speak sufficiently for themselves and I need not further dwell on this point.

Apart from these thousands of proto-organisms which thus flit about in the air, and which we at each breath draw into our lungs, there exist still other microbes more fixed and more resisting, and which can only penetrate the economy by the way of inoculation.

To judge of the value of a medicament which is supposed to have the property of destroying these divers organisms, two processes have been principally employed; the one based on experimentation on living animals, the other on fermentations.

The experimental method, that is to say, that which consists in neutralizing the different viruses by a medicament, then in inoculating them in animals, has been followed by veterinary medicine, and it is to our French veterinary school that we owe the most brilliant researches in this direction. It was Renaut who made the first tentatives of this kind, tentatives which have been pursued by Colin, by Bouley, by Chauveau, by Touissant, etc. But if this experimental method has furnished us precious information, it was impotent to establish a classification of medicaments suitable to destroy the microbes. In fact, according

to the virus employed, according to the operative procedure put in usage, according to the animals under experimentation, the results may vary, and you understand how difficult it is to found on such bases a classification of anti-microbic medicaments.

Hence it is that this process of inoculations has been reserved for the study of certain virulent principles such as that of anthrax or tuberculosis. It is in this way that Arloing, Cornevin and Thomas have studied the action of antiseptics on the anthracoid bacteridium, and Hippolyte Martin, Coze and Simon have employed the same process to decide the value of antiseptic medicaments in the destruction of the bacillus tuberculosis.

This experimental method is moreover one of the most simple, and consists in mixing well-defined micro-organisms, such as bacteria of anthrax and the bacilli of tuberculosis, with divers medicinal sub stances, and in seeing what one of these agents shall render these microbes harmless when introduced under the skin. We may, moreover, vary this experimentation; we may precede or follow the inoculation by an appropriate medication. In this chapter, which is devoted to general considerations, I cannot set forth the results of these experiments; I shall return to them, however, in another lecture, when I shall speak of the new methods of treating pulmonary diseases.

The fermentation method, on the other hand,

presents great advantages in enabling us to multiply experiments, and in rendering these sufficiently short and rapid so that a regular gradation of antiseptic medicaments may be established.

Three processes may be put in usage in this fermentation test. The first, which is the oldest, consists in mixing with certain putrescible substances medicinal liquids, and in noting those which retard or prevent putrefaction; and as far back as 1850, Pringle built on these bases a classification of anti-putrescent medicaments.

Petit in 1872 proposed another experimental process based on the quantity of carbonic acid set free by fermentable mixtures. He placed in these mixtures given quantities of certain substances and judged their anti-fermentative power by the quantity of carbonic acid set free in a given time.

But Pasteur, in showing us that putrefaction is the result of the development of special organisms in fermentable liquids, has furnished us the best means of estimating the value of medicaments called antiseptic or antifermentative, since the microscopical examination enables us to judge of the presence or absence of the proto-organisms of fermentation in the liquids.

O'Neal, in 1878 was one of the first to follow out this line of experimental research, and we have seen Bucholtz, Kuhn, Habercom, Jalan de la Croix, Gosselin and Bergeron, Miquel, Sternberg, and more re-

cently Ratimoff, perfect this method, and base upon it a classification of antiseptic medicaments.

In carrying out this line of investigation, the experimental mode has varied with the authorities. Some, as Gosselin and Bergeon,* from an exclusively chemical standpoint, reproduced in their experiments the conditions of antiseptic surgery realized by Lister. They placed in a couple of test tubes one gramme of fresh blood or serum, covering the one with simple tarlatan, the other with medicated tarlatan, and subjected them to various antiseptic sprays, taking note what effect these pulverizations had on the appearance and development of the bacteria of putrefaction.

Other experimentors have followed Pasteur's procedures in the culture of the schizophytes, and have sought to find the quantity of liquid that would antagonize the growth and multiplication of these organisms. Thus it is that Bucholtz studied in a culture liquid which bears his name, the influence of certain antiseptic substances on the bacteria developed by the fermentation of tobacco. In this way also, Koch has studied the antiseptic power of medicinal substances on the culture of anthracoid bacteria;† and Sternberg has tested

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* Bucholtz, Antiseptica and Bakterien; Untersuchungen über per Temperatur auf Bakterien-Vegetation (Arch. für experiment. Pathol., 1875, t. IV, p. 1–80 et p. 159–168). Uber das Verhalten Bacterien zu einingen antiseptica (Dissertation inaugurale, Dorpat, 1876).

† Koch über Desinfection (Mittheilungen aus dem Kaiser. lichen gesund heitsamte, B. I, 1881, pp. 234, 282).

the action of antiseptics on the micrococci of blenorrhagia, and the microbe developed by the injection of human saliva in the hare.*

Miquel has established his classification on a somewhat different basis, that is to say, on the quantity of the medicament necessary to prevent putrefaction from taking place in a litre of neutralized broth, the degree of asepsis of the medication being thus determined by the quantity requisite to obtain this sterilization.

Thus he has divided antiseptic substances into several groups: Those which are *eminently* antiseptic and which are efficacious in the proportion of from 1 to 70 centigrammes per litre; those that are *very strongly* antiseptic, from 10 centigrammes to 1 gramme being required; those which are *strongly* antiseptic in the proportion of 1 to 5 grammes; those which are *moderately* antiseptic in the proportion of from 5 to 20 grammes; those that are *feebly* antiseptic, from 20 to 100 grammes being necessary; lastly, those that are *very feebly* so, requiring from 200 to 300 grammes. Let us examine successively each of these groups.

In the substances eminently aseptic are found the salts of mercury and silver; these constitute this group. It is understood that the figures which correspond to each one of these medicaments represent

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* Sternberg, The American Journal of the Medical Sciences, April, 1883, pp. 289–299.

the minimum capable of preventing the putrefaction of a litre of broth:

Biniodide of mercury	25	milligrammes.
Iodide of silver	30	"
Oxygenated water	50	"
Nitrate of silver	80	"
Bichloride of mercury	70	"

The second group comprises certain very important medicaments; they are as follows:

Osmic acid	15	centigrammes.
Chromic acid	20	"
Chlorine	25	"
Iodine	25	"
Chloride of gold	25	"
Bichloride of platinum	30	"
Hydrocyanic acid	40	"
Iodide of cadmium	50	"
Bromine	60	"
Iodoform	70	"
Chloride of copper	70	"
Chloroform	80	"
Cupric sulphate	90	"

The third group is the longest; I will particularize the following substances:

Salicylic acid	1.	gramme.
Benzoic acid	1.10	"
Cyanide of potassium	1.20	"
Bichromate of potassium	1.20	"
Picric acid	1.30	"
Ammonia	1.40	"
Zinc chloride	1.90	"

Essence of microbalane..... ..... 2.60 grammes.
Sulphuric acid,
Nitric acid,
Hydrochloric acid, ... 2 to 3. "
Phosphoric acid,
Essence of bitter almond..... 3 "
Phenic acid.... . ..... 3.20 "
Permanganate of potash..... .... 3.50 "
Alum..... ..... 4.50 "
Tannin..... 4 80 "
Oxalic acid,
Tartaric acid, ... 3 to 5. "
Citric acid,
Sulphate of potassium ..... 5. "

The fourth group (substances moderately antiseptic) contains the following medicaments:

Bromhydrate of quinine ..... 3.50 grammes.
Arsenious acid..... 6. "
Sulphate of strychnine..... 7. "
Boric acid..... 7.50 "
Hydrate of chloral ..... 9.30 "
Salicylate of sodium..... ..... 10.00 "
Sulphate of protoxide of iron..... 11.00 "

In the fifth group, feebly antiseptic, we note:

Sulphuric ether..... 22 grammes.
Hydrochlorate of morphine..... 75 "
Ethyl alcohol..... 95 "

In the sixth and last group we find:

Iodide of potassium..... 140 grammes.
Chloride of sodium..... .... 165 "
Glycerin ..... 225 "
Bromide of potassium..... 240 "
Hyposulphate of sodium..... 275 "

When you give a general glance over the above tables, you cannot fail to note the high rank in the scale of asepsis which is occupied by the noble metals, such as mercury, platinum, silver, and gold. In a rank a little below we must place the common metals, such as copper, iron, etc. To the third rank belong the alkaline earthy metals, and a fourth place must be assigned to the alkaline metals.

Hence the attempt has been made to establish a certain correspondence between the atomic weight of the metals and metalloids and their antiseptic power; the higher the atomic weight, the greater the antiseptic power. This rule, true if you compare together mercury, platinum, and iodide of potassium, no longer finds verification if you consider such bodies as chlorine, bromine, and iodine; thus, bromine, which has an atomic weight three times larger than chlorine, has an aseptic power three times less.

The rule holds good when you examine organic bodies of a same series. Take, for example, the alcohols of fermentation;* I have experimentally shown that their toxicity follows the ratio of their atomic formula. The higher the latter, the greater their toxic power; it is the same with reference to asepsis, and the table which I here place before you makes this difference plain:

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*Dujardin-Beaumetz and Audigé, Experimental Researches on the Toxic Power of the Alcohols, Paris, 1879.

Ethyl alcohol	C^2H^6O.	Degree of asepsis,	95.
Propyl "	C^3H^8O.	" "	60.
Butyl "	$C^4H^{10}O$.	" "	35.
Amyl "	$C^5H^{12}O$.	" "	14.

To sum up, then: You see that, save in exceptional cases, we are warranted in saying that, in the same series the higher the atomic weight the greater the antiseptic power.

But if the experiments of Miquel enable us to establish a table of aseptic substances, we are far from having solved all the questions which pertain to asepsis, and the experiments of Koch, those especially of Jalan de La Croix,* made under the direction of Draggendorff at Dorpat, and finally those made still more recently in Pasteur's laboratory by Ratimoff, show us how complex is the problem with which we have to deal.

These experiments have shown that according to the micro-organisms cultivated, according to the culture medium of a same micro-organism, according lastly to the state of the latter, whether germ or developed microbe, the degree of asepsis produced by the same substance varies materially. Thus, to give an example, when you compare the action of antiseptics on the septic bacteria and on the anthracoid

* Jalan de La Croix, Das Verhalten der Bacterian das Fleischstassers gegen einige Antiseptica (Arch. für exp. Pathol., 175-225). Ratimoff, sur les antiseptiques (Arch. de phys., 1884)

bacteridia, you see that the former are much more resistant than the latter. As for the germs, they generally resist much more effectively than the filamentous bacteria. Thus, in the case of corrosive sublimate, you need a dose a hundred times stronger to kill the germs of the bacteria of anthrax than to destroy these same bacteria in the state of filaments.

The antiseptic power varies with the culture medium. To prevent the production of germs in meat broth, you require a dose of one thirteen thousand three hundred and tenth ($\frac{1}{13\frac{1}{3}10}$) of corrosive sublimate, while in the case of animal muscle twenty-six times as much is necessary. When sulphate of copper is chosen, the difference in the amount requisite for such asepsis is greater by only four times in the case of muscle, and this difference is almost *nil* with respect to boric acid, and while it takes of the latter antiseptic only $\frac{1}{100}$ to prevent the development of germs in flesh, it requires but $\frac{1}{135}$ to stay their development in broth.

But these differences are still more striking when we pass from the domain of the laboratory to that of clinical medicine, and while recognizing how useful it is to have precise notions respecting antiseptic medicaments, it is always necessary to bear in mind how difficult of application to the destruction of microorganisms developed in the economy are these notions.

When I come to speak of new pulmonary medi-

cations you will see that if the knowledge of the tubercle bacillus has enabled us better to understand the pathological anatomy and ætiology of tuberculosis, it has rendered us very meagre service from a therapeutic point of view, and all the endeavors made to destroy these bacilli when they have undergone development in the organism have thus far failed. Therefore, our colleague, Ernest Besnier, has with some reason maintained that antiparasitic or antimicrobic medications utterly failed to destroy morbid germs except so far as they destroy at the same time the living elements which contain these germs. I believe, nevertheless, that if the solution of the question presents serious difficulties, it is not insoluble. Already Pasteur by his eminently useful labors has shown us a quite particular mode of solution in creating by the inoculation of attenuated viruses a medium refractory to certain micro-organisms; possibly we shall some day find medicinal agents which, introduced into the organism, may render the latter rebellious to the culture of the micrococci, and it is in this direction that the therapeutics of virulent and infectious diseases must tend.

Apart from the interest which is connected with this classification of antiseptic medicaments, these experiments have from a therapeutic point of view given valuable indications concerning the nature of certain affections. In taking our stand on the old adage: "*naturam morborum curationes ostendunt*," when we

come to consider the high degree of asepsis of the mercurial salts and even of iodide of potassium, we might feel ourselves warranted in affirming the microbiotic origin of syphilis, and without doubt the antisyphilitic property, heretofore inexplicable, of these preparations, resides in their anti-bacillary power.

The antiseptic medication has also been applied in the form of vapors of gases or of sprays in order to destroy the numerous germs that flit about in the air. I shall not here enter into the subject of Listerian atmospheres, with which you are acquainted, but I ought to say a few words concerning the experiments which have been made in this hospital under the eminent superintendence of M. Pasteur, and his zealous co-laborator M. Roux; experiments in which the greater part of you have assisted, and which had for their end to form a correct estimate of the different processes put in use to disinfect habitations occupied by patients affected with contagious diseases. This is one of the aspects of antiseptic medication which belongs more especially to hygiene, but which nevertheless presents a great interest.

We have only made use (as you well know), of gaseous substances, such as chlorine, bromine, nitrosile, and sulphurous acid. You are well aware that this latter gas has seemed to us far preferable to any other by reason of its force of penetration, and in a communication made to the Academy of Medicine in the month of September, I gave a detailed account of

these experiments.* I shall not, then, describe them now, only reminding you that of all these gases the sulphurous is the most penetrating, and that you can obtain this gas by three methods; by burning sulphur, by employing the anhydrous sulphurous acid of Pictet, or by burning carbon bisulphide in the ingenious lamp of Kiandi Bey.

Twenty grammes (5 drachms) of sulphur per cubic metre destroy the different micro-organisms in the liquid state, but you must increase the quantity if you desire to destroy these same organisms when existing in a dry state. In fact, since my last communication to the Academy of Medicine, Dr. Bardet and myself, aided by M. Chambon, have continued these experiments on the micro-organisms in the dry state, and in particular on the vaccine virus.

We took pustules of desiccated vaccine, which we reduced to a fine powder and placed in rooms where we were burning variable quantities of flowers of sulphur.

When the quantity did not exceed 20 grammes per cubic metre, this vaccine powder did not lose its properties, and we were able by inoculating it in animals or in children to obtain a vaccinal eruption. With 30 grammes per cubic metre, the results obtained

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* Dujardin-Beaumetz, Experiments on the Disinfection of Places Occupied by Patients Sick with Contagious Affections. —Bull. de Therap. t. cvii, p. 241.

are uncertain—sometimes the inoculation succeeds, sometimes it fails, owing to the vaccine powder having lost its properties. But when the dose is attained of 40 grammes per cubic metre, the inoculations are always negative. So, then, in the case of vaccine, and probably of variola, if we would be sure of destroying the contagious germs in a dry state, it is necessary to double the quantity of 20 grammes which we had first established.

If we may rely on the experiments of Vallin and Legouest, 20 grammes suffice for typhoid fever. Forty grammes are necessary for the microbe of tuberculosis, according to Vallin. Here also, as in the case of the culture bouillon, the doses vary according to the micro-organisms under experimentation. Moreover, the results at which we have arrived are absolutely confirmatory of those which Polli obtained at Milan, Pettenkoffer at Munich, Mehlhausen at Berlin, Dougall at Glasgow, Fatio at Geneva, Pietra Santa at Paris, and lastly of the researches of Vallin, published in his able work on Disinfectants.

Such are the general considerations which I desired to present relative to the antiseptic medication as it ought to be understood in our day. I propose, moreover, to complete what I have to say on this subject, in a future lecture on "Antiseptic Pulmonary Medication," and we shall see what we have to hope from an anti-microbic treatment in its application to a bacillary disease like tuberculosis.

CHAPTER VII.

NEW PULMONARY MEDICATIONS.

GENTLEMEN: I propose to speak to you to-day of the new pulmonary medications, and I shall devote to this subject two lectures, one of which shall be reserved exclusively for the modifications introduced into the treatment of pulmonary phthisis by the discovery of the tubercle bacillus. In the present lecture I shall consider the following topics: The application of mechanical apparatus to the treatment of diseases of the thorax, and certain new medicaments addressed, the one to asthma, (viz, the *Euphorbia pilulifera*,) the others to the catarrhal affections of the lungs (are terpin and trepinol).

In the second volume of my Clinical Therapeutics I had a great deal to say about the benefits derivable from mechanical means in the treatment of pulmonary affections, and to-day there is not a large city in Europe which does not possess appliances for baths of compressed air or cabinets constructed on the type of Waldenburg's, which give both compressed and rarified air. I shall not dwell on this point now, but shall only call your attention to the great improvements effected in this pneumatic apparatus by my pupil, Dr. Maurice Dupont.

You are all familiar with Waldenburg's cabinet. This veritable gasometer has the disadvantage of being of high price, of large and ungainly size, and (in par-

ticular) of not being able to furnish at the same time compressed and rarefied air. Schnitzler, of Vienna, has done away with this latter disadvantage by providing a double gasometer, but the management of the automatic stop-cock which enables one at each stage of the respiratory movement to obtain compressed or rarefied air, is very complex and difficult, and it requires long familiarity with this instrument, which resembles at first sight a cornopean, to be able satisfactorily to use it.

Dupont's instrument, which I have adopted in my hospital service, (Fig. 4) is much more simple. Here we use the force of falling water, which by a special mechanism employed in the arts (*"procédé de la trompe"*), supplies the rarefied air which the patient breathes. As for the compressed air, this is also engendered by the water which flows from the tube into the receiver. The apparatus has but little size, costs but little, and its mechanism is very simple. In order to make it operate, it is sufficient to move the manipulator A from right to left if you would have compressed or rarefied air. By successive improvements, Dupont has succeeded in heating the air when that is desirable, and in charging it with aromatic principles.

Its only disadvantage is that, in order to make the apparatus work, a considerable water pressure is requisite, but this is only a relative inconvenience, since at the present day all our principle cities possess sys-

tems of water delivery, and the apparatus can be connected with any water faucet.

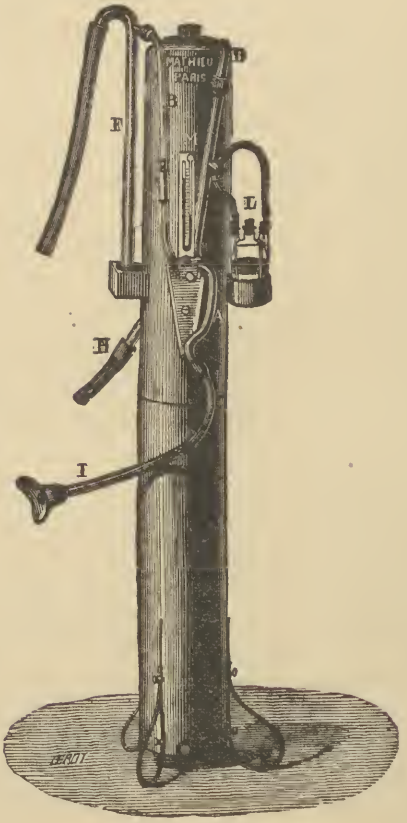

Fig. 4.

You are familiar with its modus operandi. The patient seats himself before the apparatus, and closes with the stopper the mouth-piece of the breathing tube. Then he moves the manipulator to the right or to the left; on the left it is in relation with rarefied air, on the right with compressed air; he then takes care to inspire in the compressed air and expire in the rarefied air.

Owing to the compression of the air of inspiration the air penetrates with considerable force into the entire respiratory tract, from which it issues with facility during expiration in the rarefied air; there results therefrom a true aërial lavage of the whole bronchial and pulmonary passages, the residual air which stagnates in the pulmonary vesicles being expelled.

In all the diseases in which this respiratory residuum is considerable, as in pulmonary emphysema the result of bronchial catarrh, the advantages of such medication are apparent, and if you associate with it balsamic vapors, you can thus treat with it at once both the pulmonary emphysema and the catarrh of the bronchi. This aerial lavage of the lung is the only treatment applicable to pulmonary emphysema, and with the bath of compressed air it constitutes an effectual agency with which to combat this disease.

Recently Tisy has proposed to substitute for the apparatuses of Waldenburg and Dupont a double-acting bellows, which the patient can easily manage,

for it is of small size. This apparatus is but little complicated, but it will not be likely to come into general use, for its management is fatiguing to the patient, and it takes long practice in order to manipulate it to advantage. Quite different are the means proposed by Dr. Bazile Feris, Professor of Therapeutics at the School of Naval Medicine of Brest.

Struck by the fact that the respiratory distress in the emphysematous is due chiefly to the difficulty of expiration, Bazile Feris augments the expiratory forces of the thorax by the aid of an elastic respirator. Nothing is simpler than this instrument, which you can see applied to one of my patients. It is a veritable

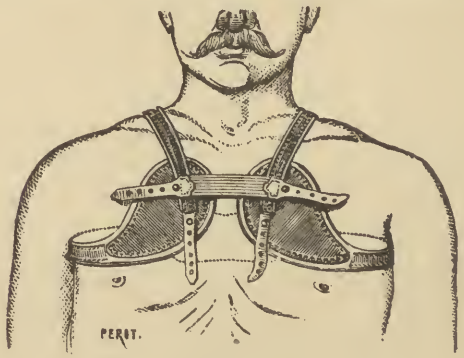

Fig. 5.

double hernial truss (see Figs. 5 and 6), which is applied over the thorax instead of over the abdomen.

It is to the dorsal region that you apply the fixed portion of the apparatus, while the two elastic portions (the spring pads), after having passed under the arms, are adjusted in front of the chest over the region of the mammæ. When the patient makes an effort of expiration, this truss, by the elastic pressure which it exerts upon the thorax, aids and favors this movement.

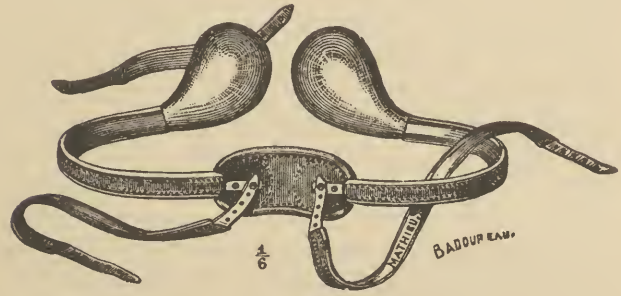

Fig 6.

Thanks to this elastic respirator, which is quite an ingenious contrivance, we see the emphysematous recover in part their respiratory functions, and you have been enabled to notice this result in my service in two of my patients, who could not engage in a brisk walk without being out of breath, while now by virtue of this apparatus, they can walk and run without difficulty. Moreover, Dr. Feris has measured the respiratory capacity of the emphysematous before and during the application of his elastic respirator, and

this respiratory capacity was always greater when the patients wore the thoracic truss. You will then be able to have recourse to this means, and the more so from the fact that the apparatus is not costly, and is easily concealed under the clothing.*

With these mechanical means you may conjoin respiratory gymnastics, which are also a useful element of cure in certain pulmonary affections, and particularly in old pleurisies. When the effusion has disappeared, there results, as you know, a diminution of capacity, which manifests itself by a deformity through life. To diminish this deformity, it is desirable to aid, as far as possible, the pulmonary parenchyma, so that it may regain the volume that it had before; and to attain this end, it is necessary by all means possible to energize the respiratory functions, and mechanically to distend the pulmonary alveoli.

In pulmonary tuberculosis, emphysema appears to be a favorable complication, in that it constitutes a barrier to the progressive invasion of the tuberculous ulceration; here, also, the distension of the pulmonary parenchyma may render you some service. You can attain this result by the aid of respiratory gymnastics.

These gymnastics may have application both to the inspiratory and expiratory muscles, and to the lung itself. In their application to the muscles, it is, by combined movements, obtained by means of the

* Bazile Feris, Bull. de Ther., t. CV, p. 104, 1883.

ingenious apparatus of Pichery, or with the methodical processes of Laisné, that you can augment their contractile force. In reference to pulmonary gymnastics, there is a little measure, very easy of execution, for augmenting the respiratory capacity, suggested by Dally: After having made a strong inspiration, you should count with a loud voice, without taking breath; you may thus attain the figure of 30, 40, 50, or even 60. You can make use of all these means, and they will give you good results. I pass now to the consideration of the new medicaments of which I have spoken: *Euphorbia pilulifera*, terpin, and terpinol.

The best anti-asthmatic medication is surely that of which the basis is iodide of potassium; and when Greene in 1860, Aubrée in 1864, Trousseau in 1869, and, more emphatically still, Germain Sée in 1868, made known the happy effects of this remedy in the treatment of asthma, they rendered to medicine a signal service; you can, in fact, see any day, in our wards, cases illustrating the truth of this affirmation.

You know very well how we formulate this treatment. We begin by moderate doses of seven or eight grains, and gradually increase them to forty, fifty, and even sixty grains a day. I was once in the habit of ordering the iodide of potassium to be taken in milk, directing my patients at the same time to drink a great deal of milk during the day—we must, in fact, to prevent the accumulation of the medicament, favor its elimination by the urine. While continuing the

usage of milk, I now think that the best vehicle for the administration of iodide of potassium is ale, which, in my opinion, disguises its taste better than anything else. You will then order the patient to take at meal-time, in a tumblerful of bitter ale, a dessertspoonful or a tablespoonful of the following solution:

℞ Iodidi potassii., ʒ iij.
Aquæ, ℥ vj.
M.

I sometimes add to the above, tincture of lobelia, in the proportion of two or three fluidrachms to the entire quantity; if, however the lobelia causes nausea, it must be omitted from the prescription.

Despite all your precautions and all your endeavors to make the iodide palatable and well tolerated, there will be persons who cannot support it, and who cannot take it in the smallest doses without suffering many of the symptoms of iodism. Therefore succedanea to iodide of potassium have been sought for, and among these I must make special mention of *Euphorbia pilulifera.* This plant has been especially studied in our hospital service by Dr. Marsset.* *Enpporbia pilulifera* belongs to the great family of Euphorbiaceæ, which has furnished to medicine very energetic purgatives, such as croton oil and caper spurge; it is an herbaceous annual plant, growing in Brazil and other tropical countries, and in

* Marsset: On Euphorbia Pilulifera, Therapeutic Gazette, Feb., 1885, p. 92; Thèse de Paris, 1884.

Australia; the specimens which served for our clinical experiments came from Queensland, Australia.

The active principle is an acrid resin which is soluble in water and dilute alcohol. When the aqueous extract or the hydro-alcoholic extract is administered to animals, such as frogs and guinea-pigs, it is observed that in the case of frogs this extract is toxic in the dose of ten to fifteen centigrammes, which corresponds, nearly, to five grammes of the dried plant to one hundred grammes of the weight of the animal. In the guinea-pig the toxic dose is less; the animal succumbing to a dose of fifty or sixty centigrammes of the extract, equivalent to about one gramme of the dried plant per one hundred grammes of the animal's weight.

When we come to inquire into its physiological effects, we note that it acts chiefly on the respiratory apparatus, and that to a period of acceleration succeeds a period of retardation of the respiratory movements and beatings of the heart; hence, it is probable that this medicine acts directly on the respiratory and cardiac centres.

Dr. Mattheson, in 1884, was the first to call attention to the action of *Euphorbia pilulifera* in the treatment of asthma, and Dr. Tison, of France, was the first to utilize this property in dyspnœas of asthmatic and even of cardiac origin.

From a pharmaceutical point of view, you may make use of the following preparations: (1) The

hydro-alcoholic extract of the plant, which may be given in the dose of ten centigrammes (one and two-thirds grains) a day; (2) or the decoction which Dr. Titson directs to be prepared by steeping half an ounce of the dried plant in two quarts of water; the dose to be three or four wine-glassfuls a day. (3) I am myself in the habit of using the tincture of euphorbia, of which I give ten drops three times a day. I recommend you to cause this prepartion to be taken shortly before meal-time in a cup of some aromatic infusion, such as polygala or wall pellitory. You will thus avoid the local irritant action which characterizes almost all the extracts of this spurge. (4) There exists, lastly, a syrup made by Hetit, which contains five centigrammes of the extract in each tablespoonful.

In patients suffering from dyspnœa, whether resulting from simple asthma, or from pulmonary emphysema, or even a cardiac affection, euphorbia has sometimes given us good results, but it will not do to give too large doses, and of the tincture, from five to ten drops, before each of the principal meals, are enough. Notwithstanding all these precautions, you will not be able to keep up this treatment more than a week without interruption, for the patients are apt to experience a burning sensation in the stomach, which results from the local irritant action of the medicament. It is, therefore, chiefly as a succedaneum of iodide of potassium, when the latter cannot be well borne, that you will resort to euphorbia.

Terpin and terpinol fulfill indications absolutely different, and are applicable in catarrhs of the lungs. In my Clinical Therapeutics I have insisted on the great advantages which may be derived from copaiba in the treatment of pulmonary catarrh, but this medication can have but limited application; for, to say nothing of the repugnance which many people have toward copaiba, and its unfortunate association in the minds of most people with gonorrhœa (which increases the prejudice against it), there are certain unpleasant physiological effects often attendant on its use, such as eructations, diarrhœa, and divers cutaneous eruptions, which militate against the usefulness of this drug.

Therefore, while recognizing how happily copaiba modifies expectoration, it is only in hospital practice that I apply this excellent medicament to the treatment of pulmonary catarrh. I believe that I have found in terpinol a very fortunate substitute for copaiba, and one which offers all the advantages of the latter, without any of its disadvantages.

When turpentine is distilled in presence of an alkali, there is obtained a special hydrocarbon having for formula $C_{10}H_{16}$; this is *terebinthen*, which undergoes hydration, and thereupon furnishes a white, solid, crystalline body, which is the *hydrate of terebenthen*, or *terpin.* This terpin, in presence of an acid such as sulphuric or hydrochloric, is transformed into an oily body, to which has been given the name of *terpinol.*

Terpin was employed for the first time in therapeutics by Prof. Lepine, of Lyons, and, as a result of experiments on man and animals, he found that this body might be with advantage substituted for turpentine, and that it acted as expectorant and diuretic; his dose of terpin is twenty to sixty centigrammes (three to ten grains). We have reproduced in our service the trials of Prof. Lepine, and our pupil, Dr. Guelpa, has interested himself particularly in this undertaking. Terpin presents a real inconvenience in its slight solubility, requiring, as it does, 200 parts of cold water to dissolve one part of this substance; therefore, it is necessary to have recourse to alcohol in order to obtain active solutions; which is a drawback when one desires to prescribe it for diuretic purposes.

We have given terpin in much larger doses than M. Lepine; we have administered one, two, and even three grammes a day without obtaining any well-marked diuretic effect; so, in accordance with Tanret's suggestion, we have substitutsd terpinol for terpin.

Terpinol is an oily liquid body, which gives forth a very strong odor of tuberose (*Polyanthes tuberosa*), and especially of gardenia (Cape jasmine). Adrian has made for me capsules with terpinol, each containing ten centigrammes (one and two-thirds grains),and we give our patients six, eight, ten, and even twelve of these capsules a day. Terpinol may also be given in pill form, and here we give Tanret's formula,which

can hardly be improved upon: Take of terpinol, benzoate of soda, of each, ten centigrammes (one and two-thirds grains), sugar, q. s. for one pill. These pills contain the same quantity of terpinol as the capsules.

We have made several experiments on animals, and have noted: 1. The rapid elimination by the respiratory passages of terpinol, which long imparts its special odor to the breath: 2. Its feeble elimination by the urine, which also gives forth the odor of terpinol, though much less markedly than the breath.

We then made trials of terpinol in two orders of complaints, pulmonary catarrh and affections of the urinary passages. As might have been foreseen, it was in pulmonary catarrh that we obtained the best results, since it is chiefly by the pulmonary surface that terpinol is eliminated. The sputa become more fluid, their bad odor disappears, and expectoration is facilitated. In affections of the urinary organs, the results have been almost *nil.* As a diuretic and modifier of the urine, it has shown itself very much inferior to turpentine.

So that if we were to attempt to classify these three substances, turpentine, terpin, and terpinol according to their therapeutic effects, we should say that for the catarrhal affections of the bronchi, terpinol deserves the first place, and turpentine the last, while in the case of catarrh of the urinary organs, the order is exactly the reverse. This completes what I

have to say at present on the subject of new pulmonary medications.

In the next lecture I shall set forth the therapeutic modifications which have resulted from the discovery of the tubercular bacillus.

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